DRAFT DAMAGE ASSESSMENT AND RESTORATION PLAN/ ENVIRONMENTAL ASSESSMENT

for the
FORT LAUDERDALE
MYSTERY OIL SPILL

FORT LAUDERDALE, FLORIDA AND VICINITY

National Oceanic and Atmospheric Administration, U.S. Department of Commerce,

and the

Florida Department of Environmental Protection

June 24, 2002

TABLE OF CONTENTS

i. Summary

This Draft Damage Assessment and Restoration Plan and Environmental Assessment ("Draft DARP/EA") has been prepared by State and Federal Trustees to address restoration of natural resources and services injured by an oil incident in the Fort Lauderdale area on August 8, 2000, that was caused by an unknown party. The purpose of restoration, as outlined in this Draft DARP/EA, is to make the environment and public whole for injuries to natural resources and natural resource services resulting from the mystery spill incident by returning injured natural resources and natural resource services to "baseline" conditions, i.e., the conditions that would have existed had the incident not occurred, and compensating for interim losses of natural resources. For this incident the National Oceanic and Atmospheric Administration ("NOAA") of the U.S. Department of Commerce and the Florida Department of Environmental Protection ("FDEP") have the responsibility as natural resource Trustees to: assess the nature, extent, and severity of natural resource injuries, plan for appropriate restoration projects, prepare draft and final restoration plans, and implement restoration.

Under Section 1002 of the Oil Pollution Act (33 U.S.C. § 2701 *et seq*.; "OPA"), each party responsible for a vessel or a facility from which oil is discharged, or which poses a substantial threat of a discharge of oil, is liable for natural resource damages resulting from the incident involving such discharge or threat. There is no identified responsible party to pay for the damage claim in this incident, however the OPA allows for claims to be submitted to the Federal Oil Spill Liability Trust Fund for payment in the absence of a known responsible party. The measure of damages recoverable by Trustees as defined in Section 1006(d) of OPA equals the sum of: the costs to restore, rehabilitate, replace, or acquire the equivalent of the injured resources; compensation for the diminution in value of injured resources pending their recovery; and the reasonable costs of assessing these damages. All recoveries for the first two elements are to be spent implementing a plan developed by the Trustees to restore, rehabilitate, replace, or acquire the equivalent of the injured natural resources.

This Draft DARP/EA is intended to inform members of the public and to solicit their comments on the Trustees' assessment of resource and service losses attributable to the mystery incident and on the restoration actions that the Trustees are proposing to implement for those losses. Comments received by the Trustees during the public comment period will be considered in finalizing the Draft DARP/EA.

1.0 Introduction and Purpose

1.1 Introduction

This document summarizes the natural resource Trustees' assessment of injuries to public natural resources resulting from the August 2000 Fort Lauderdale, Florida mystery oil spill (the "incident"). In addition, it sets forth the Trustees' recommendations for restoration projects to restore resources to their baseline and to compensate for the interim loss of resources and/or services pending recovery to baseline. This document also serves in part as the agencies' compliance with the National Environmental Policy Act (NEPA) and the State of Florida's

equivalent (see Section 4 for additional information). The public may review and provide comments on the planned restoration activities.

This information was prepared by the Florida Department of Environmental Protection and the National Oceanic and Atmospheric Administration of the United States Department of Commerce (collectively, "the Trustees").

The regulations for conducting a natural resource damage assessment for incidents covered by OPA are published at 15 C.F.R. Part 990. In accordance with these regulations, the Trustees selected methods for injury assessment and restoration planning that are technically reliable and valid and were cost-effective for the incident.

The Trustees investigated several resource injuries caused by the incident and consulted with a variety of experts in relevant scientific and technical disciplines. Based on this work, the Trustees believe that the incident caused the loss of public beach use and significantly injured sea turtles, fish and invertebrates, and seabirds. The Trustees will use restoration costs as the measure of damages for injuries to the ecological resources. These costs, when finalized, will include the costs to design, permit, construct, and monitor the restoration projects. Injuries and losses to the use of public beaches were more cost-effectively quantified in terms of lost value to resource users. For this category of injury, the Trustees propose restoration actions that will be conducted with recovered funds to provide replacement services to resource users.

The description and evaluation of restoration alternatives in this plan are based on the technical expertise, judgments and restoration experience of the Trustees and other consulting scientists. Following consideration of public comment on this draft DARP/EA, the Trustees will issue a Final Restoration Plan describing the proposed projects. Those projects will then undergo appropriate planning and design, construction, implementation, and monitoring. Any permit applications will also be subject to a public comment period under federal, state, and local laws prior to final project design and implementation.

1.2 Description of the Incident

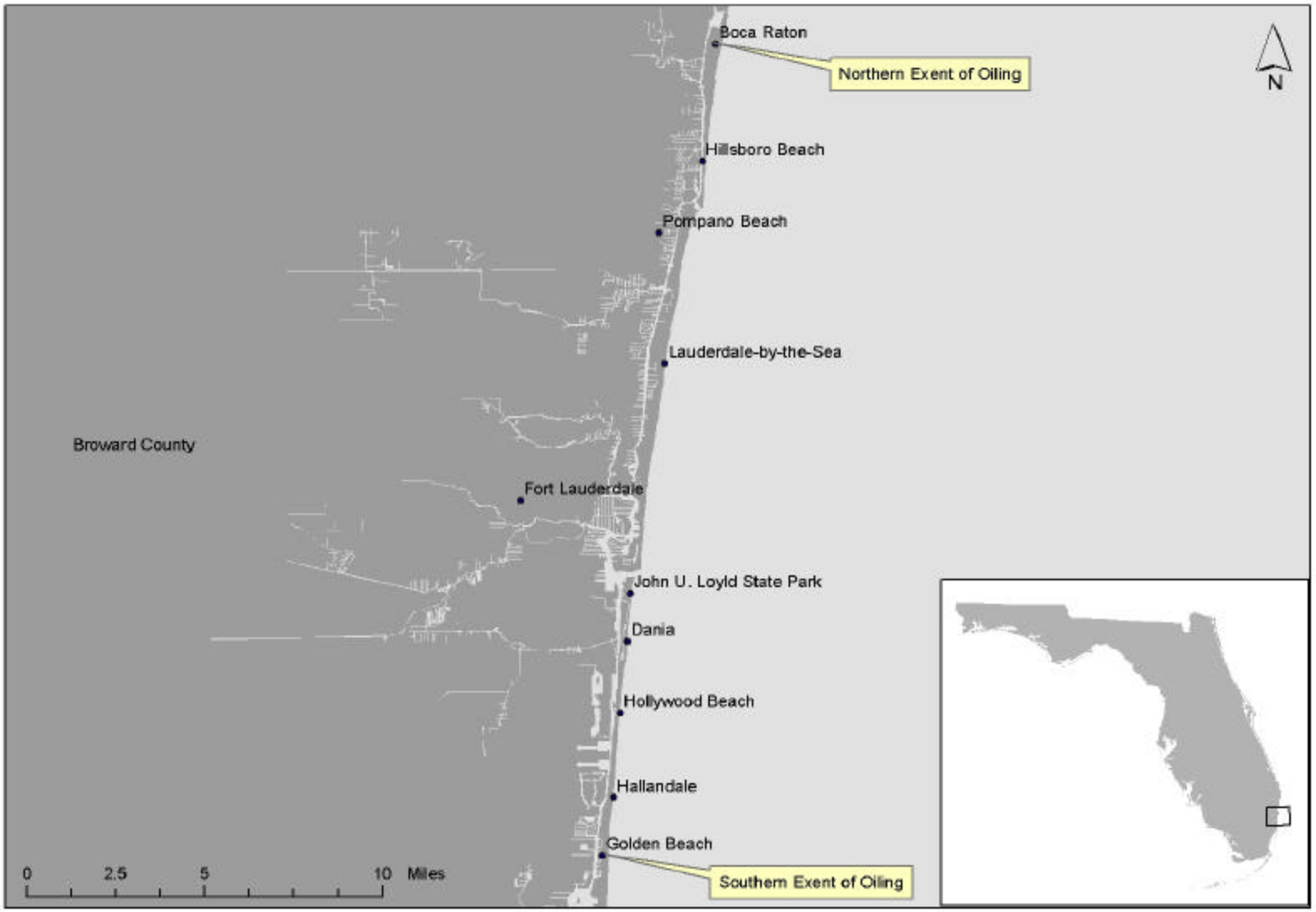
On Tuesday morning, August 8, 2000, oil tar balls and oil mats were observed on beaches in the area of Fort Lauderdale, Florida. Within the next few days, approximately 20 miles of high-use recreational beaches, from North Miami Beach northward to near Pompano Beach (primarily Broward County beaches), were oiled and had to be cleaned (see Figure 1 for a map of the oiled area). The origin of the oil is unknown. The Coast Guard, the lead response agency for the incident, classified the spill as medium, and the Trustees have estimated the amount of oil stranded on the shoreline to be approximately 15,000 gallons.

Natural resources or their services impacted as a result of the incident include threatened and endangered sea turtles and their habitats, marine surface waters and their biota including fish, birds, and recreational use of beaches. Response actions removed the majority of the shoreline oil within a few days of oiling. However, these response actions did not prevent natural resource impacts from occurring; likewise, these response actions did not operate to restore or rehabilitate natural resource injuries that resulted from the discharge of oil.

1.3 Affected Environment

This section provides brief descriptions of the physical and biological environments affected or potentially affected by the incident and targeted for restoration activities, which occur largely in Broward County and to a lesser extent in Brevard, Palm Beach, and Dade Counties. The physical environment includes the marine waters of the Atlantic Ocean and the adjacent coastal habitats. The biological environment includes a variety of fish, shellfish, sea turtles, and birds. The cultural environment of Broward County is also discussed.

FIGURE 1: OIL SPILL IMPACTED AREA



The southeast coast of Florida in the area of the incident contains several habitats; sand beaches are the most dominant and widely recognized. The beaches were created from marine and freshwater processes that have alternated with the rise and fall of sea level (United States Geological Survey, 1996). The resultant beaches have become prime public recreation areas. They also serve as nesting grounds for threatened and endangered sea turtles as well as habitat for plant and animal species. Portions of this valuable habitat are in a constant state of erosion: the State of Florida has estimated that 21 of 24 miles of beach in Broward County are critically eroding. The County, with the support of the Federal government, has undertaken several measures including shore protection, beach restoration, and sand management to maintain the beach habitat.

Coastal wetlands are another type of habitat in the vicinity of the incident. These wetlands consist of saltwater mangrove swamp areas along the Intracoastal Waterway and its adjoining canals, with some intermittent salt marsh areas. The wetlands provide habitat for wading birds and nursery areas for saltwater fish.

Natural and artificial reefs are both present offshore of Broward County. The natural reefs are low profile, shallow water reefs with corals and sponges and are purportedly the northernmost shallow coral reefs on the Atlantic Coast. In addition to the existing natural reefs, Broward County has been creating artificial reefs since 1982. The County has deployed a number of different materials for the purpose of providing substrate. The natural and artificial reefs are habitat for fish and invertebrates as well as sites for recreation, including fishing and diving.

The beach habitat provides critical nesting areas for sea turtles. Three species of sea turtles nest on Broward County beaches annually; they are the loggerhead sea turtle, the green sea turtle, and the leatherback sea turtle. The loggerhead, which is Federally-listed as threatened, is the most common nesting turtle in Broward County. The green and leatherback turtles are Federally-listed as endangered.

The coastal habitats provide important nesting, feeding, and loafing areas for shorebirds and seabirds. Close to 300 species of birds have been observed in South Florida, 60 percent of which are migratory (Robertson and Kushlan, 1984). Species that use the beach community include plovers, terns, cormorants, pelicans, and gulls. The roseate tern and piping plover are two species that are Federally-listed as threatened.

The marine waters, including the artificial and natural reefs, support fish and invertebrate communities. The system provides for foraging, shelter, and reproduction for a variety of fish and shellfish species including snappers, drums, dolphinfish, spiny lobsters, shrimp, and stone crabs. Recreationally and commercially important fish using these habitats include snook, grouper, and snapper species. One researcher documented the occurrence of 192 species of fishes on the nearshore hardbottom reefs of east Florida (United States Fish and Wildlife Service, 1999).

Appendix A contains a list of all Federally-listed threatened and endangered species found in south Florida. The inclusion of a species on the list does not necessarily indicate that individuals are found in the area of the incident and/or the proposed restoration, "...but is

included here because many of these species are known to exist within or use the approximately 20 miles of impacted shoreline and ocean areas. Because of the presence of several endangered or threatened species, ESA/EFH consultation on this Plan has been initiated with the USFWS and NMFS (see Section 4 for additional information).

In addition to the habitats and biological resources that occur in the vicinity of the incident there is also recreation and tourism, most of it derived from beach use. Broward County beaches attract 7.2 million visitors a year who spend approximately $422 million annually. It is estimated that more than 60 percent of overnight tourists would not have gone to the County if there were no beaches. Other marine recreation in the area includes boating and sport fishing. Cruise ships sail from Port Everglades, which is at the southern end of Fort Lauderdale.

The cultural setting for this incident is an urbanized area with a service-oriented economy, due to the significance of tourism. Two municipalities whose beaches were impacted by the incident, Fort Lauderdale and Hollywood, have populations that exceed 100,000 people. The population for Broward County as a whole is approximately 1.4 million. The service-oriented economy has more retail and service sector jobs than is typical nationally or statewide with 54 percent of all jobs being in the service and retail sector (Broward County Economic Profile, 1996 data). Other important sectors include transportation, communication and public utilities, and local government.

1.4 Natural Resource Trustees and Authorities

Natural resource Trusteeship authority is designated according to Section 1006(b) of OPA, Executive Order 12777, October 22, 1991 (56 FR 54757), and Subpart G of the National Oil and Hazardous Substances Pollution Contingency Plan. 40 CFR Part 300. Federal Trustees are designated by the President, and State Trustees by the Governor. Acting on behalf of the public as Trustees for the living and non-living resources in the coastal and marine environments of Florida, the National Oceanic and Atmospheric Administration and the Florida Department of Environmental Protection are responsible for assessing injuries to trust resources resulting from incidents, and for developing and implementing a plan for the restoration, rehabilitation, replacement, or acquisition of the equivalent of injured natural resources ("restoration plan"). OPA § 1006(c).

Pursuant to Section 1002(a) of OPA, each party responsible for a vessel or facility from which oil is discharged, or which poses a substantial threat of a discharge of oil, into or upon the navigable waters of the United States or adjoining shorelines, is liable for natural resource damages from incidents that involve such actual or threatened discharges of oil. OPA Section 1006(d)(1) defines the measure of damages to natural resources as the cost of restoring, rehabilitating, replacing or acquiring the equivalent of the injured natural resources, compensation for the diminution in value of those natural resources pending restoration, and the reasonable costs of assessing such damages. All recoveries for the first two elements are to be spent implementing a restoration plan developed by the Trustees. OPA § 1006 (f).

In this case, there is not an identified responsible party to pay damages. When there is not a responsible party, the Federal Oil Spill Liability Trust Fund is available to pay claims for the

costs of assessing natural resource damages and for developing and implementing restoration plans. OPA § 1013 (b)(1)(A).

1.4.1 Determination of Jurisdiction to Conduct Natural Resource Damage Assessment

Pursuant to Section 990.41 of the regulations for conducting natural resource damage assessments ("NRDA") under OPA, 15 CFR Part 990, the Trustees determined that legal jurisdiction to pursue restoration under OPA exists for this incident. The oil spill constitutes an "incident" within the meaning of Section 1001(14) of OPA - an "occurrence or series of occurrences having the same origin, involving one or more vessels, facilities, or any combination thereof, resulting in the discharge or substantial threat of discharge of oil." Although a responsible party was never identified, this incident most likely originated from a vessel transiting the area. Because the discharge was not authorized by a permit issued under Federal, State, or local law, and did not originate from a public vessel or from an onshore facility subject to the Trans-Alaska Pipeline Authorization Act, the incident is not an "excluded discharge" within the meaning of OPA Section 1002(c). Finally, natural resources covered by the Trusteeship authority of NOAA and/or Florida have been injured as a result of the incident (natural resource injuries are discussed more fully below). These factors established jurisdiction to proceed with an assessment under the OPA NRDA regulations.

1.4.2 Determination to Conduct Restoration Planning

In accordance with 15 CFR Section 990.42, the Trustees for this incident also determined that the requisite conditions existed to justify proceeding with natural resource damage assessment and restoration planning beyond the preassessment phase. These conditions, discussed more fully below, include: existence of natural resource injuries resulting from the discharge or from associated response actions; response actions inadequate or inapplicable to restoration of natural resource injuries and losses; and existence of feasible actions to address the injured resources. Thus, the Trustees acted appropriately in proceeding with the damage assessment and restoration planning process.

1.5 Public Participation

OPA Section 1006(c)(5) requires that the Trustees involve the public in the restoration planning process. The OPA NRDA regulations interpret this provision as requiring, at a minimum, that Trustees provide the public with the opportunity to comment on a draft damage assessment and restoration plan, and that public comments be considered in producing the final plan. 15 CFR Section 990.55(c). This Draft DARP/EA is intended to inform members of the public about the incident and the Trustees' activities, and solicit their comments on the results of natural resource injury studies and proposed restoration projects. The type, size, and design of recommended restoration alternatives may be adjusted based on public input and/or additional scientific findings. The Trustees believe that public input is essential to the restoration process.

NEPA and its implementing regulations (40 CFR Parts 1500-1508) outline the responsibilities of federal agencies under NEPA and provide specific procedures for preparing environmental documentation. Generally, when it is uncertain whether an action will have a significant effect

on the quality of the human environment, federal agencies begin the NEPA planning process by preparing an environmental assessment (EA). The EA undergoes a public review and comment period and then the comments are reviewed by, in this case, the Trustees. The federal agency approving official makes a determination as to whether or not these proposed actions constitute a major federal action significantly affecting the quality of the human environment, triggering either the need for a more comprehensive environmental impact statement to be conducted on these projects or by issuing a Finding of No Significant Impact (FONSI). Depending on the selected projects, there may be project-specific environmental assessments that will also undergo a public comment process and review by permitting and regulatory agencies.

The Trustees published a Notice of Intent to Conduct Restoration Planning in the Federal Register on July 31, 2001, as well as publishing notices in local newspapers, soliciting possible proposals for restoration projects for this incident. The Trustees also had numerous discussions with the counties in which impacts occurred to develop the selected preferred restoration alternatives.

The Trustees have established a 30-calendar-day comment period for the Draft DARP/EA. The Trustees will consider public comments before finalizing the Draft DARP/EA. The deadline for comments is given in the public notices issued by the Trustees to announce the availability of this document. An additional opportunity for public review will be provided in the event that significant changes in the evaluation or selection of restoration projects transpire.

Please direct your comments on the Draft DARP/EA to the Lead Administrative Trustee:

National Oceanic and Atmospheric Administration
Damage Assessment Center
SSMC4, RM. 10218
1305 East-West Highway
Silver Spring, MD 20910-3281
Attn: Tony Penn
Tony.Penn@noaa.gov

1.6 Administrative Record

The Trustees have maintained records to document the information considered by the Trustees as they have planned and implemented assessment activities and addressed restoration and compensation issues and decisions. These records are compiled in an administrative record, which is available for public review at either of the addresses listed below. The administrative record facilitates public participation in the assessment process and will be available for use in future administrative or judicial review of trustee actions to the extent provided by Federal or State law. An index of those documents that have been included in the administrative record to date is attached as Appendix F to this document. Additional information and documents, including public comments received on the Draft DARP/EA, the Final DARP/EA, and restoration planning documents, will be included in the administrative record as they are developed.

Documents within the administrative record can be viewed at the following locations by appointment through the persons indicated:

National Oceanic and Atmospheric Administration
General Counsel Natural Resources
SSMC3, RM. 15132
1315 East-West Highway
Silver Spring, MD 20910-3282
Attn: Linda Burlington
Linda.B.Burlington@noaa.gov

Florida Department of Environmental Protection
Bureau of Emergency Response
3000 NE 30th Place
Ft. Lauderdale, FL 33306
Attn: Terry Edwards
954-202-3000

1.7 Summary of the Natural Resource Damages Claim

The goal of a claim for natural resource damages under OPA is the restoration of injured natural resources and their services. Two types of restoration were considered for this incident: primary and compensatory restoration. Primary restoration is any action taken to accelerate the return of injured natural resources and their services to baseline condition, i.e., the condition that would have existed had the incident not occurred. Natural recovery, in which no human intervention is taken, is a primary restoration alternative that must be considered for each incident. Compensatory restoration is any action taken to compensate for interim losses of natural resources and/or services pending recovery to baseline.

The Trustees determined and quantified injuries in four main categories: 1) recreational beaches (Section 3.3); 2) sea turtles (Section 3.4); 3) water column injuries to fish and invertebrates (Section 3.5); and 4) seabirds (Section 3.6).

Subject to public comments, the Trustees selected the preferred primary and compensatory restoration alternatives shown in Table 1.

Table 1: Preferred Alternatives to Address Natural Resource Injuries and Services

Injury Category	Primary Restoration	Compensatory Restoration
Recreational Beach Use	Natural Recovery	Various Recreation Projects
Sea Turtles	Lighting Ordinance Enforcement & Alternative Roadway Lighting	Lighting Ordinance Enforcement & Alternative Roadway Lighting
Fish and Invertebrates	Natural Recovery	Mangrove Habitat Creation
Seabirds	Natural Recovery	Educational Signage

This incident does not have an identified responsible party. The U.S. Coast Guard has officially stated that they are no longer attempting to identify the party responsible for the oil discharge. Legal notices were published by the U.S. Coast Guard in south Florida newspapers advertising the process by which Oil Pollution Act claims resulting from this incident, including natural resource damages claims, may be submitted to its Federal Oil Spill Liability Trust Fund for payment, in the absence of a known responsible party.

2.0 Selection of Injuries to Include in the Assessment

2.1 Description of Natural Resource Injuries and Service Losses

The mystery incident and response adversely affected a number of natural resources. Trustees may pursue restoration costs for natural resource injury, loss or destruction. The OPA NRDA regulations define "injury" as "an observable or measurable adverse change in a natural resource or impairment of a natural resource service." 15 CFR Section 990.30. The regulations define "services" as "the functions performed by a natural resource for the benefit of another natural resource and/or the public." 15 CFR Section 990.30. The mystery incident injured or destroyed natural resources and caused reductions in natural resource services.

Recreational Beach Use: The incident resulted in the oiling of approximately 20 miles of shoreline along the Broward County coast. These shorelines are primarily sand beaches and many miles of recreationally-important beaches were oiled by the incident. The presence of oil and cleanup activities precluded swimming, sunbathing, and other beach recreation for up to a week in the most heavily impacted areas.

Sea Turtles: The best estimate for hatchling mortality due to the incident is 7,800, most of which were loggerhead turtles. There was a small injury to post pelagic juveniles and adult sea turtles.

Invertebrates and Finfish: Approximately 10,930 kilograms of finfish and invertebrates were estimated lost due to the incident. The injury is the sum of the biomass equivalent of a direct kill plus future growth of the killed animals had there not been an incident. Finfish, mostly jacks and snappers, made up most of the biomass.

Birds: An estimated 12 seabirds were killed as a result of exposure to the surface oil. The birds were primarily cormorants.

2.2 Application of Injury Selection Criteria

The NRDA regulations for OPA at 15 CFR Section 990.51(f) describe several factors to guide Trustees in the selection of potential injuries to include in an assessment. These factors are:

(1) The natural resources and services of concern;
(2) The procedures available to evaluate and quantify injury, and associated time and cost requirements;
(3) The evidence indicating exposure;
(4) The pathway from the incident to the natural resource and/or service of concern;
(5) The adverse change or impairment that constitutes injury;
(6) The evidence indicating injury;
(7) The mechanism by which injury occurred;
(8) The potential degree, and spatial and temporal extent of the injury;
(9) The potential natural recovery period; and
(10) The kinds of primary and/or compensatory restoration actions that are feasible.

Based upon consideration of the above, the Trustees chose to include lost recreational beach use, sea turtles, fish and invertebrates, and birds in the assessment underlying this Draft DARP/EA. The Trustees judged that the injuries were significant and that procedures for assessing injury and scaling appropriate restoration for these categories would involve reasonable costs (Penn, 2002a; Jeansonne, 2002a).

3.0 Restoration Planning

3.1 Injury Assessment, General

The goal of injury assessment is to determine the nature, degree, and extent of any injuries to natural resources and services. This information is necessary to provide a technical basis for evaluating the need for, type of, and scale of restoration actions. Specifically, the Trustees must determine that there is: (1) exposure, a pathway, and an adverse change to a natural resource or service as a result of an actual discharge; or (2) an injury to a natural resource or impairment of a natural resource service that resulted from the substantial threat of a discharge.

Injury determination and injury quantification are terms used to describe the two basic components of an injury assessment. Determination of injury requires that Trustees demonstrate that the incident caused an adverse effect on the resources or services. Injury quantification involves determining the severity, extent and duration of the adverse effect. Trustees have the option of quantifying the adverse effect directly and/or quantifying the reduction in services provided by a natural resource caused by the incident. The natural resource or service change is defined as the difference between post-incident conditions and baseline conditions. Injury

assessment techniques used for the natural resource categories chosen by the Trustees for inclusion in restoration planning are discussed later in this document.

3.2 Developing a Restoration Plan, General

3.2.1 Primary and Compensatory Restoration

In selecting preferred restoration projects for each category of natural resource injury or loss, the Trustees identified feasible restoration actions to promote recovery of the resources to baseline (primary restoration) and/or to compensate for interim losses of resources or services pending recovery (compensatory restoration). Primary restoration actions include natural recovery and one or more active restoration actions designed to directly restore natural resources or services to baseline on an accelerated time frame. The Trustees propose active primary restoration for the sea turtle injury category and natural recovery for the other categories.

Compensatory restoration actions compensate the public for the interim losses. The scale of the compensatory restoration action is based on knowledge of the interim losses associated with the selected primary restoration action. The OPA NRDA regulations identify a variety of methods that may be used for scaling compensatory restoration actions. When determining the scale of restoration actions that provide natural resources and/or services of the same type and quality, and of comparable value as those lost, Trustees must consider using a service-to-service scaling approach. Under this approach Trustees determine the scale of restoration actions that will provide a flow of natural resource services equivalent in quantity to the lost flow of services, taking into account the different time periods in which the services are provided through the use of discounting. This approach is employed below for the recommended sea turtle, bird, and aquatic fauna (fish and invertebrate) compensatory restoration actions.

When Trustees determine that the service-to-service approach is not appropriate, Trustees may use the valuation scaling approach. With this approach, Trustees explicitly measure the lost value associated with injured resources and/or services and then determine the scale of restoration actions necessary to produce natural resources and/or services of equivalent value to the public. If, in the judgment of the Trustees, valuation of the lost services is practicable, but valuation of the replacement natural resources and/or services cannot be performed within a reasonable time frame or at a reasonable cost, Trustees may calculate the dollar value of the lost services and select the scale of restoration action that has a cost equivalent to the lost value. The latter approach is employed for the beach use injury. This approach was used because the Trustees determined that the more complex procedures necessary to value the services provided by the selected restoration actions would not furnish enough increased information to justify the additional costs in this incident.

3.2.2 Criteria for Evaluating Restoration Alternatives and Environmental Consequences

In accordance with the OPA NRDA regulations, only those alternatives considered technically feasible and capable of being implemented in accordance with applicable laws, regulations and/or permits may be considered for inclusion in a restoration plan. 15 CFR Section 990.53

(a)(2). The Trustees evaluated the feasible restoration alternatives for each category of injury or loss according to the following criteria set forth in 15 CFR Section 990.54:

(1) the cost to carry out the alternative;
(2) the extent to which each alternative is expected to meet the Trustees' goals and objectives in returning the injured natural resources and services to baseline and/or compensating for interim losses;
(3) the likelihood of success of each alternative;
(4) the extent to which each alternative will prevent future injury as a result of the incident, and avoid collateral injury as a result of implementing the alternative;
(5) the extent to which each alternative benefits more than one natural resource and/or service; and
(6) the effect of each alternative on public health and safety.

The Trustees added another criteria to be considered when evaluating the restoration alternatives:

(7) The extent to which each alternative is consistent with applicable management plans, including recovery plans for the threatened and endangered sea turtles.

3.2.3 Environmental Consequences (Indirect, Direct, and Cumulative)

To restore resources and/or services lost as a result of the Incident, the Trustees examined a variety of proposed projects under the following restoration alternatives: (1) no action and natural recovery, (2) ecological restoration, and (3) lost human use restoration. The Trustees intend to avoid or reduce negative impacts to existing natural resources and services to the greatest extent possible. However, in implementing or approving the implementation of restoration actions, the Trustees could undertake actions that may have short- or long-term effects upon existing habitats or non-injured species. Project-specific environmental consequences for each proposed project are provided in Section 4. This section addresses the potential overall cumulative, direct, and indirect impacts, and other factors to be considered in both the OPA and the NEPA regulations.

The Trustees believe that the projects selected in this restoration program will not cause significant impacts to natural resources or the services they provide. Further, the Trustees do not believe the proposed projects will affect the quality of the human environment in ways deemed "significant."

Cumulative Impacts: Since the Trustees designed the projects primarily to improve recovery of injured natural resources, the cumulative environmental consequences will be largely beneficial. These cumulative impacts include restoration of the injured ecosystem by increase in numbers of sea turtles and seabirds, protection of some endangered and threatened species, and enhancement of habitat. Certain projects may also provide educational opportunities. Both project and NEPA monitoring of projects funded under this Final RP/EA will confirm that cumulative impacts will be beneficial rather than adverse. Any unanticipated cumulative adverse effects on an area or other area program, plan, or regulatory regime from a proposed project identified prior to implementation will result in reconsideration of the project by the Trustees.

Indirect Impacts: Environmental consequences will not be limited to the project location. Indirect beneficial impacts will occur in other parts of the County. Cumulative impacts at the project locations, and in the surrounding area, are expected to increase populations of seabirds, provide improved habitats for marine mammals and biota in intertidal and subtidal habitats, and provide a greater understanding of

human interaction with natural resources. These projects could indirectly benefit a variety of federally *threatened and endangered species* and State-listed sensitive species by improving habitats utilized during the lives of these species.

Direct Impacts: Overall, this Final RP/EA will enhance functionality of ecosystems. However, there will be some short-term impacts from the proposed projects, which are discussed in Section 4 of this document

See Section 4 for a discussion of potential impacts to the coastal zone and to endangered and threatened species.

Any project that requires a permit for implementation will integrate best management practices, other conditions, and consultations to ensure that the project will be constructed in accordance with federal, state, and local regulations.

3.2.4 Monitoring

The OPA NRDA regulations specify that a draft restoration plan must include a description of monitoring needed to document restoration progress, performance, and success. Monitoring is an essential component of any restoration project. Monitoring focuses on selected features of the restored systems at periodic intervals and ensures: 1) an objective assessment of performance criteria established in the restoration plan, and 2) permit compliance. Monitoring may include the collection of certain baseline information prior to any restoration activity. Most importantly, monitoring allows objective evaluation of the need for any mid-course corrections. The monitoring actions judged appropriate for the preferred restoration alternatives are discussed in the injury-specific restoration sections below.

3.3 Recreational Beach Use Injury and Restoration Plan

3.3.1 Injury Determination and Quantification

3.3.1.1 Description of the Injury

On the morning of August 8, 2000, oil tar balls and oil mats were observed on beaches in the area of Fort Lauderdale, Florida. Although the exact origin and amount of the oil spilled is unknown, the amount stranded on beaches has been estimated to be approximately 15,000 gallons. As a result of the incident, recreational beaches along a 20-mile stretch from Boca Raton south to Golden Beach were impacted (see Figure 1). Beaches were affected by the presence of tar on the beaches, oil in the water, and by the presence of cleanup crews. Several beaches in the affected area were closed to swimming. By August 10, all of the beaches were fully open although the cleanup was not officially complete until August 16, 2000.

The beaches that were affected are high-quality, high-use recreational beaches. The beaches generally offer large expanses of sand and good surf. In some areas there are also boardwalks, piers, shops, and other amenities. The warm weather beaches attract residents and tourists alike, both in large numbers. The affected beaches are in densely populated south Florida and the area is well known as a tourist destination. Beachgoers typically engage in general beach recreation,

including sunbathing, picnicking, and swimming, and shoreline and near-shore activities such as walking, cycling, and roller-skating.

Because of the conditions of the beach due to the incident, including beach closures to swimming, marine patrols and lifeguards reported reduced visits to a number of beaches, a fact later documented through beach attendance logs. Diminution in recreational use of public beaches clearly constitutes an injury as defined by OPA and the NRDA regulations, in that use by the public constitutes a service provided by a natural resource. 15 CFR Section 990.30. Injury also occurs when beachgoers continue to visit the affected beaches and suffer a loss of enjoyment due to the presence of oil. The causal link between these injuries and the incident was verified by documentation of the presence of oil and response teams on the beaches, and the return of beach visitation to baseline levels after the oiling and response activities ceased.

The focus of this portion of the assessment is on the injuries resulting from lost use of the affected beaches. Beachgoers who did not attend the affected beaches (who normally would have absent the oil) suffered one of two types of injury: they either cancelled their beach recreation altogether and lost the value of the would-be trip; or they substituted their trip to an alternative, less preferred site, which by definition means incurring some amount of lost value. This assessment does not address the lost value for trips taken to the affected beaches due to lack of data on the beachgoers' perception of the degraded conditions.

3.3.1.2 Injury Quantification

Injury quantification consisted of estimating the reduction in beach visits that occurred due to the presence of oil. The reduction in visits is obtained by subtracting the number of visits that occurred during the incident from the number of visits that would occur during a no incident condition (or baseline condition).

Managers at the beaches affected by the incident were contacted for information to assess the number of affected visits (number of users who would normally attend, but did not). The greatest recreational impacts occurred at Fort Lauderdale Beach, John U. Lloyd Beach State Park Recreation Area, Dania Beach, and Hollywood Beach. Each of these beaches was closed to swimming on August 8 and 9, 2000.[1] It is for these beaches that the number of affected trips are calculated.[2]

Using attendance data based on lifeguard counts and, in the case of John U. Lloyd Beach State Park, on the count of individuals that entered the recreation area, the number of affected trips can be calculated. Attendance data were obtained for the two weeks prior to the incident, the week

[1] Closure information was provided by personal communication between Tony Penn of NOAA and Captain Tom Fogen, Captain Glenn Morris, Jim Shoemaker, and Sidney Leve. Fogen, Morris, and Shoemaker serve marine rescue departments at Fort Lauderdale, Dania, and Hollywood beaches, respectively; Leve is the Park Manager at John U. Lloyd beach.

[2] Communication with managers of beaches in the far northern and southern portions of the spill-affected zone suggested that there were minimal impacts in these areas.

of the incident, and the two weeks subsequent to the week of the incident (see Appendix B for the data and a description of the how the data were collected). The data for the week of the incident provide the number of visits that occurred during the incident and the data for the two weeks before and after the incident provide the baseline attendance.[3] Impacts are assessed from Monday through Friday for the week of the incident beginning Monday, August 7, 2000. No impacts are assessed for the Saturday and Sunday following the incident (8/12/00 and 8/13/00) as Hurricane Debby threatened South Florida this weekend and it was not possible to separate out weather-related impacted trips.

The affected trips are categorized as resident trips. According to an individual with the Hollywood Fire/Rescue Beach Safety Division, during the time of year when the beaches were oiled, most beachgoers are area residents.[4]

At Fort Lauderdale Beach average attendance was 26,706 per week for the two weeks, Monday through Friday, before and after the incident. Attendance during the week of the incident was 22,545. Thus, for the week, there were an estimated 4,161 impacted trips due to the incident.

The average weekly attendance at John U. Lloyd Beach for the two weeks before and after the incident was 4,357 individuals. Attendance during the incident week was 2,895. Therefore, an estimated 1,462 trips were affected due to the incident.

For the two weeks before and after the incident, the average weekly attendance at Dania Beach was 1,300 individuals. An estimated 610 individuals visited the beach during the incident week. Thus, an estimated 690 visits were affected.

The average weekly attendance at Hollywood Beach for the two weeks before and after the incident was 46,853 individuals. There were an estimated 35,161 users during the week of the incident. An estimated 11,692 trips were affected at Hollywood Beach due to the incident.

It is important to consider if weather contributed to the number of affected trips before attributing the full effect to the incident. Weather is an important factor that determines the level of beach recreation as rain usually deters beach recreation. The Trustees collected surface weather data from the National Climatic Data Center for the month of August at Fort Lauderdale/Hollywood International Airport (see Appendix C). For the week of the incident, August 7–11, rain was only reported at three hourly observations, twice late in the afternoon on the 10th measuring only a trace and once late in the afternoon on the 11th , also measuring a trace. The hourly observations show many more reportings of rain for the weeks before and after the

[3] The data reveal that use of the oiled beaches was affected for approximately one week even though the beaches were closed to swimming for only two days. Attendance for the two weeks before and after the spill week was used to estimate baseline as those weeks are the nearest time periods with a no-spill scenario.

[4] To the extent that affected non-resident trips are counted as resident trips, the estimate of natural resource damages will be conservative. Studies that measure natural resource use consistently show that a non-resident's (tourist's) value from natural resource use is higher than that of a resident's on a per day basis (see Bell and Leeworthy, 1986; Karou, 1993; and Morey et al., 1995).

incident when the baseline number of trips was estimated. This suggests that weather, specifically rainfall, did not account for the reduction in beach recreation.

Therefore, based on the attendance figures at the four beaches and taking account of the weather, a total of 18,005 would-be trips were not taken at the Fort Lauderdale, John U. Lloyd State Park, Dania, and Hollywood beaches due to oil on the beach and in the water, perceptions of oil on the beach and in the water, or presence and activity of response teams.

3.3.2 Lost Beach Use Restoration Planning

3.3.2.1 Preferred Primary Restoration Alternative

Primary restoration of oiled beaches was accomplished through the incident response, in that oil was physically removed from shorelines, and oiled sand was cleaned and returned to the beaches. In the Trustees' judgment, natural resource losses requiring restoration consist solely of the interim loss of public use of beach resources. Therefore, no other primary restoration alternatives were considered.

3.3.2.2 Preferred Compensatory Restoration Alternatives

Compensatory restoration is required to offset the interim beach use losses. The Trustees considered the following alternatives as compensation for the beach use impacts.

1. Sea Oat Plantings: The Trustees considered sea oat plantings as a way to develop or restore a beach dune system that would in turn enhance and maintain beaches for future human use by preventing erosion and loss of beach sand. Beach managers throughout Broward County support plantings as a way to stabilize beaches that are in a state of chronic erosion. The same managers note that the sea oat plantings would complement the beach re-nourishment project that is scheduled for the near future by helping to hold the new sand on the beach, which would limit the need for future renourishment. Further supporting the feasibility of this alternative are the Broward County Coastal Revegetation Plan and the Broward County Coastal Stabilization Dune Restoration Plan.

2. Dune Walkovers: Dune walkovers provide two functions beneficial to beach-goers: they provide access to the beach; and provide an alternative to trampling the dunes, which stabilize and preserve the beach. Dune walkovers have been successfully constructed in the past and there are opportunities for walkovers in other areas, including John U. Lloyd State Park.

3. Carts for Handicapped: The carts under consideration provide transportation over sand and would allow the handicapped access to beaches, thus generating new beach trips as compensation for those that were lost. Beach managers at John U. Lloyd State Park, Hollywood, and Fort Lauderdale beaches identified the carts as potential needs not funded under existing budget initiatives.

4. Shade Provision: Shaded areas on the beach improve beach quality by providing beach-goers with areas of respite from the sun; in some cases, the existence of shade areas might encourage

beach use from individuals who otherwise would not go. The Trustees identified two mechanisms to supply more shade, through construction of all-natural wood huts (or "chickees") and planting groups of native palm trees. Beach managers throughout Broward County support shade provision through one mechanism or the other.

3.3.2.3 Non-Preferred Compensatory Restoration Alternative

NEPA requires the Trustees to consider a "no-action" alternative and the OPA regulations require consideration of the equivalent, the natural recovery option. However, OPA clearly establishes the Trustees' responsibility to seek compensation for interim losses pending recovery of the natural resources and their services. In the case of recreational beach losses, the no-action alternative would not address these losses. Losses were suffered during this incident and technically feasible, cost-effective alternatives exist to compensate for these losses. Therefore, the Trustees rejected the no-action alternative for lost recreational beach use.

3.3.2.4 Evaluation of Beach Use Compensatory Restoration Alternatives

Sea oat plantings meet the goal of restoring lost beach use by enhancing beaches and maintaining them for future use. Plantings have been documented to provide a beach stabilization function (Broward County Coastal Revegetation Plan and the Broward County Coastal Stabilization Dune Restoration Plan). These plans also document the use of sea oat plants for previous beach stabilization projects in the County and call for additional revegetation. Therefore, a new planting project is likely to succeed and is consistent with management plans. Sea oats are not expected to cause collateral injury; sea oats would be planted on dunes or at the upper end of beaches outside of turtle nesting zones. As a natural habitat, sea oats and the resultant dunes provide multiple benefits to other natural resources, such as hiding places for birds and lizards. Protected dunes may also benefit sea turtles, which prefer to nest up against the dunes. The Trustees estimated the effect of sea oats on public health and safety to be neutral. The Trustees received sea oat planting project proposals from Broward County beaches affected by the incident totaling approximately $1.2 million.

Dune walkovers address the lost beach use during the incident by providing increased opportunities to access recreational shorelines; they also enhance beaches and protect them for future use by protecting dunes and dune vegetation, which stabilize beaches. In providing protection, the dune walkovers avoid collateral injury to sea oats and dunes. Dunes and dune vegetation support multiple benefits so the walkovers indirectly provide multiple benefits. Walkovers also protect the public and promote public health and safety by providing easy access for emergency personnel. Because dune walkovers have been successfully constructed in the past and there are opportunities for new walkovers, this type of project is likely to succeed. Also, this type of project is consistent with coastal zone management plans. The Trustees received a request from John U. Lloyd State Park for three dune walkovers at a total cost of $100,000.

Handicapped carts provide transportation and allow the handicapped access to beaches, thus carts generate new beach trips as compensation for those that were lost. Given the identification of carts as a potential need by Broward County beach managers, the Trustees judged this

restoration option likely to succeed and consistent with management plans. The carts are neutral in their ability to avoid collateral injury and benefit multiple resources or services. The carts do, however, benefit public health and safety because they safely provide the handicapped access to the beach. Handicapped carts cost $2,000 to $2,500 each.

Shade areas can make up for the lost beach trips by enabling individuals who are sun sensitive an opportunity to enjoy beaches that they would otherwise not visit. Shade areas also improve public health and safety for existing beach-goers by providing areas of respite from the sun. There are proposals to provide shade through chickees and tree plantings and these types of projects have been implemented in the past, so the Trustees judged the alternative as likely to succeed. For the remaining criteria, ability to avoid collateral injury, ability to benefit multiple resources or services, and consistency with management plans, the Trustees scored the alternative as neutral. The Trustees received a number of project proposals at a total cost of $78,320.

The Trustees selected all of the restoration alternatives for the beach use injury category as co-preferred alternatives. The Trustees judged the variety of services provided by the various projects to be desirable in a plan to restore the use lost as a result of the incident. The mix of alternatives maintains beaches for future use, provides access to the beach, and improves the quality of the beach experience. In this way, the alternatives all meet the goal of restoring injured resources and services. Further, the alternatives have been implemented elsewhere so they are likely to succeed.

Scaling the Restoration Alternatives: Use of Value-to-Cost Approach

Pursuant to Section 990.53(d) of the OPA NRDA regulations, Trustees must determine the scale, or size, of each project that would be necessary to adequately compensate for the resource services lost. The NRDA regulations require Trustees to first attempt to scale projects on a service-to-service basis, where the restoration project is the size that provides the same amount of services that were lost. 15 CFR Section 990.53(d)(2). This scaling approach is only applicable when the lost services and replacement services are of the *same* type and quality. Restoration projects that provide replacement services of *comparable* type and quality require use of a valuation scaling approach, in which Trustees determine the amount of natural resources and/or services that must be provided to produce the same value lost to the public.[5] 15 CFR Section 990.53(d)(3). To do valuation scaling, Trustees first measure the value of the injured resources and/or lost services. Then, if practicable, Trustees determine the dollar value of replacement natural resources and/or services. This is called the value-to-value approach. Where valuation of the *replacement* services is not feasible or cannot be done at a reasonable cost, the Trustees may determine the dollar value of the lost services and select the scale of compensatory restoration actions that has a cost equivalent to the lost value ("value-to-cost scaling"). 15 CFR Section 990.53(d)(3)(ii).

[5] If the replacement services are the same type and of comparable quality as the lost services, then the service-to-service approach is still applicable if the metric used to measure the resources and services can adjust for quality differences.

There were no feasible compensatory restoration alternatives that would provide additional resources and services of the same type and quality and of comparable value as those lost (i.e., beach visits). The identified alternatives of beach access and beach quality improvements enhance the beach experience for existing beach-goers, but it is not expected that they generate new beach trips as compensation for those trips that were lost altogether.[6] Beach/dune system stabilization through sea oat planting is closest to providing services of the same type and quality that were lost. If the beach is maintained or preserved due to system stabilization, it could provide additional beach trips in the future that may be directly related to the lost trips. However, the costs of trying to attribute the number of beach trips gained from the restoration are prohibitive given the complexities involved in these types of determinations. For the affected trips where beach-goers went to alternative, less preferred sites, the benefits from access and quality improvements are not the same type and quality as what was lost either.

Since the conditions for using the service-to-service scaling approach are not met, the Trustees determined that it would be appropriate to use a valuation scaling approach. However, the Trustees determined that the cost of valuing the replacement services provided by the identified alternatives is not reasonable for this incident. The Trustees believe the additional costs of a valuation study would not result in a commensurate increase in information necessary to apply value-to-value scaling; further, the cost of the study to value restoration benefit would likely be more than the value of the injuries. Thus, the scale of restoration for lost beach use was determined using the value-to-cost approach.

Valuation of Affected Beach Trips

The correct measure of the value of a recreation trip is the average consumer surplus per trip. Consumer surplus is the measure of an individual's value of a good, in this case recreation, above and beyond any payments that are necessary to obtain that good. The change (net) in consumer surplus as a result of an environmental impact is the consumer's measure of economic loss. This concept of net consumer surplus is applied in economics to measure losses under a wide range of circumstances, for example, impacts on consumers from changes in food prices, losses from outages in water or power supply, as well as disruptions of outdoor recreation due to oil spills or other pollution.

As an example of individual consumer surplus loss, suppose a person refrains from taking a day trip to their preferred beach due to a beach quality change at that site. Suppose further that the cost of the beach recreation would have been $25 for cost of food and travel. If the individual is willing to pay $45 for a day of beach recreation at their preferred site, then the consumer surplus loss – or the value above and beyond minimum required expenditures – is $20 per foregone trip.

The estimate of the value of an affected beach trip (either foregone or substituted to an alternative site) by the public for this case was derived using a methodology economists refer to as benefits transfer. Benefits transfer methods utilize value estimates previously generated for other similar resources or services to estimate a value for the specific resource or service of

[6] The provision of carts for the handicapped that allows them access to the beach (a beach access restoration project) could generate new beach trips, but they are not the same types of trips that were lost.

interest, as opposed to conducting new surveys and studies to measure the value of a resource or service.

Benefits transfer is an accepted method for conducting natural resource damage assessments. It is suggested as an assessment method in Appendix B to the preamble of the NOAA regulations. 15 CFR Part 990. Also, the Department of the Interior uses benefits transfer in its Type-A model to value the loss of natural resources (including beach recreation) resulting from the release of oil and other substances covered by the "Superfund" Act. 42 U.S.C. § 9601 *et seq*. The Type-A model, and thus the use of benefits transfer under the Superfund Act was upheld by the U. S. Court of Appeals, District of Columbia Circuit in *National Association of Manufacturers v. U. S. Department of the Interior*.[7]

In this case, the value of an affected beach trip is transferred and the total value loss of the affected trips is the number of trips multiplied by the transferred value per trip. The similarity of the affected trips in this case with the studied trips is of obvious importance.

The Trustees believe the most appropriate study from which to transfer a beach value is a study of beach use in the Tampa area, which was conducted in association with an oil spill that occurred there in 1993 (Environmental Economics Research Group, 1998). Like the Fort Lauderdale beaches under consideration for this case, the Tampa beaches affected by the 1993 spill represent high-quality beaches of considerable extent located near a substantial urban population. Similar to the affected beachgoers in this case, the Tampa study was a study of Florida resident beach users. The study estimated central Florida's residents' value loss associated with beach closures along approximately 16 miles of Tampa area beaches. The lost value (or change in consumer surplus) was from residents forgoing beach recreation trips altogether or going to an alternative, less preferred site – the same impacts that are under consideration for the mystery incident. In the Tampa study, the value loss per affected resident trip was $26.43 in year 2000 dollars (see page 103 of the report for the value in 1998 dollars). The study also revealed that Atlantic Coast beaches are more valuable than Gulf Coast beaches, all else equal. So, the value per would-be trip to Fort Lauderdale area beaches is not less than the value for Tampa area beaches.

While the Tampa area beaches and the assessment of recreational impacts there are unique, the value per trip is within the range of per unit values for various related outdoor activities. Walsh et al. (1992) compiled a listing of studies completed between 1968 – 1988. The mean value per day for swimming is $34.82 (year 2000 dollars) and $26.27 (2000 dollars) for picnicking, based on eleven and seven studies, respectively. The value per day of resident beach recreation in the Department of Interior Type-A model is $14.52 (2000 dollars), which is based on seven studies of resident beach recreation throughout the United States. The Type-A value, which is a national average where some beaches have a consumer's surplus above average and others have a surplus value below average, is not representative of the high-quality Fort Lauderdale beaches on the "Gold Coast" of Florida. Thus, the Trustees appropriately selected the Tampa beach use value to apply to the mystery incident.

[7] 1998 WL 11824 (D.C. Cir.)

Using the number of affected trips and the value per affected trip, in addition to a few other parameters, the value of damages can be calculated. There were 18,005 affected trips in the year 2000. Assuming that the lost trips will not be compensated for until 2003 (year restoration is expected), the value per affected trip in 2003 dollars is $28.75 (inflated Tampa value of $26.43 in 2000 dollars using the CPI for all urban consumers) and the value loss associated with the 18,005 affected trips totals $517,643.75 in 2003 dollars. Given restoration is not expected to occur until 2003 and the injury occurred in 2000, the Trustees have to adjust – or discount – the damages to account for the value of time. The Trustees believe that a rate of three percent reflects the social rate of time preference, the rate at which society is willing to substitute between present and past consumption of natural resources and services.[8] Then, the value of losses in 2003 dollars, adjusted for the time delay of restoration, is $565,643.30. Thus, this establishes the scale of the restoration projects, as this is the amount of money that will be available to fund the selected alternative(s).

Project Selection

The Trustees received sea oat planting proposals from Fort Lauderdale, Hugh Taylor Birch State Park, John U. Lloyd State Park, Dania Beach, and Hollywood Beach. Fort Lauderdale requested funds to maintain existing sea oats. The Trustees propose to fund their $3,000 request to implement actions that would keep people out of their sea oat beds. Birch State Park is seeking 20,000 square-feet of sea oats to complete a vegetation plan for the Park. The Trustees propose to fund this proposal as well. John U. Lloyd State Park requested 268,150 square-feet of sea oat plantings. At an approximate cost of $2.50 per square foot, this proposal would exceed the dollars recovered for the beach use injury. Thus, the Trustees propose to fund planting a section of the total area, consisting of a 37,500 square-foot area near the beginning of the Barrier Island Nature Trail. The Park has also requested two dune walkovers in this area. The Trustees decided that the revegetation coupled with two walkovers would make a good project to stabilize the beach and provide access. The Trustees support Dania Beach's request for $9,361 to fill in vegetation along part of a dune line that was washed out in a storm event. Hollywood Beach proposed planting 190,000 square feet of sea oats. The Trustees do not have the resources to support all of this area, however the Trustees propose to fund 121,525 square-feet of sea oats at the beach. This amount of sea oats should fund replanting a dune line and planting at street ends that were identified as high priority by the city. The estimated cost of the proposed sea oat projects totals $461,186. The estimated budget for each municipality is presented in Table 2. These projects would be implemented by the Broward Soil and Water Conservation District through an agreement with the Trustees.

[8] For further discussion of discounting and an explanation of the three percent discount rate see NOAA (1999).

Table 2: Budget for Sea Oat Restoration

	Sea Oat Cost
Fort Lauderdale	$3,000
Birch State Park	$50,000
John U. Lloyd	$95,000
Dania Beach	$9,361
Hollywood Beach	$303,812
TOTAL COST	**$461,173**

Dune walkovers stabilize the beach by keeping pedestrians off of the dunes, and they provide convenient beach access. John U. Lloyd State Park was the only location to propose walkovers and they proposed three of them. As mentioned in the previous paragraph, the Trustees propose to fund construction of the two walkovers east of the parking lot (at the beginning of the nature trail) in concert with the revegetation project. The estimated cost for two of the walkovers is $70,000. The Trustees would anticipate providing these funds for planning and implementation directly to the Park, which is part of FDEP.

Specially designed handicapped carts provide access to the beach for a group of people who might not otherwise go to the beach. The Trustees received a specific request to fund these carts from John U. Lloyd State Park. The Park does not currently have handicapped carts; other beaches in Broward County have carts or they have not expressed a need for carts. The Trustees propose to provide the Park with three handicapped carts, at an estimated total cost of $6,000. The Trustees would provide funds directly to the Park to purchase the carts.

Tree plantings and chickees supply shade areas that can improve beach-going for users and may generate new beach trips by those who would not go to the beach without shade. Dania Beach submitted a proposal to place fifteen chickees on the beach at a total cost of $18,000. The Trustees propose to fund construction of these chickees, which are 10 feet by 10 feet wall-less huts, as a direct way of providing shade. The Trustees would provide funds to Dania Beach for implementation.

The other requests to provide shade consisted of tree plantings, proposed by John U. Lloyd State Park, Fort Lauderdale, Hollywood, and Dania Beaches. The Trustees determined that the Fort Lauderdale proposal – to add trees within a picnic area – was acceptable. At Hollywood Beach, the proposal was to plant trees at street ends amid existing or proposed dune vegetation. The Trustees questioned whether the main benefit from such trees was to provide shade for people since it is not desirable to have people in the dunes. There was a similar concern with the proposal at John U. Lloyd State Park that the trees would not mainly provide shade for people. The Trustees rejected the tree-planting proposal at Dania Beach since they are supporting chickees there. Thus, the Trustees propose to fund tree plantings, primarily sea grapes, at Fort

Lauderdale beach at an estimated cost of $10,470. These funds would be provided to the municipality through an agreement with the Trustees.

The costs of the restoration projects for lost beach use are summarized in Table 3.

Table 3

COSTS OF BEACH USE RESTORATION

Category	Cost
Sea Oats	$ 461,173
Dune Walkovers (2)	$ 70,000
Handicapped Carts (3)	$ 6,000
Chickees (15)	$ 18,000
Trees	$ 10,470
Total	**$ 565,643**

3.3.2.5 Monitoring Plan for Beach Restoration

The handicapped carts, chickees, trees, and dune walkovers would be maintained by John U. Lloyd State Park and the municipalities that are receiving them. Therefore, no additional funds are needed to ensure that the projects succeed. Limited monitoring would be conducted as part of the sea oat project and reports would be provided to the Trustees. Expenses for this monitoring work are included as part of the overall project budget.

3.4 Sea Turtle Injury and Restoration Plan

3.4.1 Injury Determination and Quantification

3.4.1.1 Description of the Injury

At the time of the incident, within the general geographic area exposed to the oil, there were an estimated 530 sea turtle nests on the beaches, each with an average of 116 eggs and 55% hatching success rate (Witherington, 2001). Sea turtle hatchlings swim offshore and linger in the coastal waters for a few days to two months before entering the Gulf Stream and starting their pelagic stage. An estimated 137,050 loggerhead, green, and leatherback sea turtle hatchlings (hatched in the previous 30 days) were in the area and potentially exposed to the oil slick from this incident, and, according to modeling work, some were killed as a result of the oiling. There were also approximately 77 adult sea turtles, mostly nesting females, and 326 post-pelagic stage juveniles that were exposed in the area of the incident.[9]

[9] Jeansonne (2001a) contains the estimates for sea turtle abundance during the incident.

3.4.1.2 Injury Quantification

Injury to the sea turtle resources was calculated using the computer based Spill Impact Model Analysis Package (SIMAP), modified with site- and incident-specific information about turtle presence and abundance, and environmental conditions during the incident. The SIMAP calculated the number of hatchlings, adults, and juveniles killed as a result of exposure to the spilled oil at the ocean surface as the slick transited through the area before stranding on the beaches. For the hatchlings, the Trustees estimated that mortality would occur to 50% of the hatchlings in the area swept by the slick (Jeansonne, 2001b). The estimated mortality represents a combined factor that includes both the high likelihood of contact with the oil by hatchlings, and, if contacted by the oil, a high mortality rate from smothering and/or toxic oil effects. For the older age classes of sea turtles, benthic juveniles and adults, a 1% mortality factor is estimated since the older turtles spend a majority of their time below the sea surface, and would also be more resistant to smothering and toxicity than hatchlings due to their larger size (Jeansonne, 2001b).

The SIMAP estimate for hatchling mortality is 7,800 individuals; for the post pelagic juveniles and adult sea turtles, the injury is calculated as a fraction of juvenile and a fraction of an adult killed[10] (French-McCay et al., 2001). Appendix D of this draft DARP contains a copy of the wildlife injury quantification of the SIMAP report, which details the calculated sea turtle injuries by age class. The proportion of injury by species as calculated by the SIMAP, is directly proportional to their relative population densities in the area (86% loggerheads, 14% greens, and 0.1% leatherbacks).

3.4.2 Sea Turtle Restoration Planning

3.4.2.1 Preferred Primary Restoration Alternatives

The goal of primary restoration is to accelerate the return of sea turtles to their baseline levels quicker than the natural recovery rate. In this context, the restoration goal is to replace the 7,800 sea turtle hatchlings and the juvenile and adult killed by this incident as quickly as possible and ideally in a single hatching season. The juvenile and adult injury is equivalent to 357 hatchlings, in other words, it takes 357 hatchlings to generate the juvenile and adult that were lost (Jeansonne, 2002b) so the restoration objective is 8,157 hatchlings.[11] The alternatives described are the preferred primary restoration alternatives.

1. Enforcement of Turtle-Friendly Lighting Ordinances: The Trustees investigated opportunities to augment lighting ordinance enforcement activities that would comprise restoration by preventing mortality of turtles. Disorientation upon nest emergence is the greatest source of mortality for sea turtle hatchlings and is primarily caused by hatchlings crawling towards artificial lights and not towards the moon and the ocean. Thus, actions to correct beach lighting

[10] A fraction of a juvenile and an adult can be killed as estimation of mortality is based on a model that uses statistical probabilities.

[11] The Trustees propose to restore the juvenile and adult injuries by creating an increased number of hatchlings that would survive to those life stages.

problems would be an appropriate restoration alternative in that they would prevent future mortality of turtle hatchlings that crawl toward these artificial light sources, instead of toward the ocean.

Palm Beach and Brevard Counties both have the potential for augmented turtle-friendly lighting ordinance enforcement. These Counties have high concentrations of nesting loggerhead turtles and they have well-established mandatory lighting ordinances requiring conversion of residential and commercial beachfront lighting to lighting that cannot be seen on the adjacent beaches. County commissioners and their representatives report that they are stretched to their limit in terms of funds to pay for enforcement of turtle lighting ordinances during the nesting season. These Counties are enthusiastic about the possibility of enhanced funding for overtime pay for existing code enforcement personnel or for hiring of seasonal code enforcement personnel. The Trustees considered Broward County, the site of the incident, for enforcement support. The County adopted a change to its land use plan requiring municipal ordinances to be in place and enforceable in February 2001, with a one-year grace period expiring on February 16, 2002. Thus, there are no baseline enforcement statistics from which to determine whether and how augmenting enforcement might result in the restoration of turtles by preventing hatchling mortality in Broward County. Consequently, the Trustees looked outside of Broward County for enforcement projects.

2. In-Road Street Lighting: This restoration alternative is considered another solution to the artificial lighting problem. The project would take street lights off of raised poles and install them in the lane stripes in the roadway (or install them on shorter poles on the side of the road). The Florida Department of Transportation has been conducting a pilot study in Boca Raton using this technology, and has preliminary results indicating significant effectiveness in preventing turtle hatchling disorientation. The Trustees believe that altering street lighting as in this pilot project is a viable restoration alternative in areas where street lighting is the primary cause of sea turtle hatchling disorientation because street lights are not covered by county turtle lighting ordinances (areas of Palm Beach County and Brevard County are under consideration).

3.4.2.2 Non-Preferred Primary Restoration Alternatives

1. Natural Recovery: The Trustees do not expect natural recovery of sea turtles because of their status as threatened and endangered. This alternative would not involve any direct human intervention to restore, or cause accelerated recovery of, the injured resources. Natural recovery will not necessarily occur for this injury, however. Sea turtle reproductive potential will not naturally replace the killed individuals, as numbers of these species are critically low, and currently require extensive and ongoing efforts to assist them in recovering to a more stable and resilient reproductive status.

2. Sea Turtle Nesting Beach Acquisition: Acquisition for public ownership of privately owned land to protect turtle nesting beaches is a restoration alternative that could protect turtle nests and hatchlings. An identified priority project in sea turtle recovery plans is to add parcels to the existing Archie Carr National Wildlife Refuge, in Brevard and Indian River Counties. There are known populations of sea turtles nesting each season at the refuge, with the highest density of nests recorded at 1,000 per acre. . The Trustees are not proposing beach acquisition because the

additional benefits to hatchlings are uncertain and acquisition is not cost-effective compared to the lighting alternatives.

Evaluation of Primary Restoration Alternatives and Environmental Consequences

Losses to species in danger of extinction, such as sea turtles, will not likely be restored through natural recovery, thus this injury must be restored through active primary restoration.

Augmenting lighting ordinance enforcement has been documented as effective in reducing turtle hatchling mortality. By saving hatchlings that otherwise would have died, new hatchlings are added to the environment and the resource can be brought back to baseline. Lighting enforcement is consistent with the Endangered Species Act recovery plan for the loggerhead sea turtle, which comprised the vast majority of the hatchlings killed by the incident. The Trustees expect lighting enforcement to succeed as they propose to augment existing lighting ordinance enforcement programs and practices. There are no detrimental effects to other wildlife by eliminating artificial lights that illuminate turtle nesting beaches at night. If anything, the results of these actions have incidental benefits to other nocturnal wildlife (e.g., bats, insects, raccoons). Except as noted above, the lighting enforcement is not expected to benefit other natural resources or services injured as a result of the incident. The Trustees judged this alternative to have a neutral effect on public health and safety, because the project only involves the expanded enforcement of an existing ordinance. Brevard County estimates that $95,900 is required to effectively augment its turtle lighting code enforcement (Barker, 2002), covering the costs of personnel, vehicles and fuel during the turtle nesting season over the course of three years.[12] Palm Beach County estimates that $67,500 is needed for the same period to augment their turtle lighting enforcement program, for salary and overhead including vehicle costs (Davis, 2002a). The total cost of $163,400 for this alternative is conservatively expected to save approximately 10,000 hatchlings from disorientation over the course of three years in the two Counties combined.

The extent to which purchasing and transferring private property to Archie Carr National Wildlife Refuge would result in the production of new hatchlings (directly or through prevention of mortality) is not certain. Turtles already nest on private property that has been identified for addition to the Refuge, thus new hatchlings would be produced only to the extent that the addition to the Refuge would create better conditions for nesting, or prevent conditions that would reduce nesting and hatching success in the future. The acquisition of property is consistent with the Endangered Species Act recovery plan for the loggerhead sea turtle. Beach acquisition can be successfully implemented as willing sellers of beachfront property have been identified. The acquisition of beachfront property is not expected to cause collateral injury; in fact, the addition of beachfront to the Refuge benefits all wildlife that uses such lands. Beach acquisition is not expected to have any effect on public health and safety. Acquisition of property desirable to add to the Refuge in Brevard and Indian River Counties costs on average

[12] The Trustees would support enforcement for a discrete period; it is important to the Trustees to provide restoration quickly and they would not want to pay for the project indefinitely. Ideally, all replacement hatchlings would be provided in a single batch, as they were lost. However, no alternatives were identified that could accomplish that goal.

$4,000 per linear foot of beachfront and the minimum purchase size is 100 linear feet (Sramek, 2002). Thus, the minimum cost is $400,000.

Conversion of street lights to embedded lighting is effective in reducing turtle hatchling mortality. By saving hatchlings that otherwise would have died due to disorientation, the resource can be brought back to baseline. Embedded lighting is consistent with the Endangered Species Act recovery plans for sea turtles. The alternative is likely to succeed as pilot projects of embedded lighting have been successfully implemented by the Florida Department of Transportation. Converting elevated street lights to embedded lights causes no collateral injury. Some nocturnal wildlife may benefit from darker nighttime skies, though the lighting project is not expected to benefit other natural resources and services that were injured as a result of the incident. The Trustees determined that this alternative does not impact public health and safety. The pilot project on street light conversion demonstrated no increases in safety-related incidents such as automobile crashes. Street light conversion to embedded lighting is expected to cost approximately $50,000 per mile and to save approximately 1,065 hatchlings per mile per year from disorientation in Palm Beach County. Palm Beach County has identified 2.9 miles of roadway as highly suitable for implementation of street light conversion (no other sources of artificial light pollution along these stretches of beach).

3.4.2.3 Preferred Compensatory Restoration Alternatives

Under any of the primary restoration actions considered, there is a period when turtles are below their baseline level and there is an interim loss. Thus, compensatory restoration is necessary. The Trustees evaluated compensatory restoration alternatives to compensate for the lost turtles pending their recovery to baseline.

The actions the Trustees considered for primary restoration are also appropriate to provide compensatory turtle resources and services. The primary restoration alternatives support sea turtle resources and services, which are what are lost in the interim period. So, the Trustees evaluated the same alternatives – as described under "Primary Restoration Alternatives Considered" – for compensatory restoration.

Based upon the alternative evaluation analysis above, the Trustees selected both the lighting enforcement and the embedded lighting projects as co-preferred alternatives to replace the turtles killed as a result of the incident and to compensate for the interim losses.

Project Selection

The Trustees first preference is to fund the ordinance enforcement actions in Palm Beach and Broward Counties. Resource managers in both Counties advised the Trustees that additional enforcement was by far their preferred approach to conserving sea turtle resources, based upon their judgments and experience about the need for and the success of enforcement actions. Also, the Trustees determined that funding additional ordinance enforcement actions should occur in both Counties to provide hatchlings with more genetic diversity than would be produced from a single County, and to hedge against unforeseeable effects that might impact nesting or hatching in one County in any given year. Scaling shows that enough replacement and compensatory

hatchlings are produced in a three-year time period (a more detailed discussion can be found in the next section) so the Trustees do not propose to implement a street light conversion project.

Restoration Project Scaling

In order to scale compensatory restoration, it is first necessary to determine the primary restoration requirement. The Trustees have to replace 8,157 hatchlings to bring the sea turtle injury back to baseline. To achieve the primary restoration objective during a three-year restoration program, 2,719 hatchlings must be restored annually.[13]

The Trustees used a service-to-service scaling approach to determine how many additional hatchlings must be saved annually to compensate the public for the interim sea turtle losses that occur from the time of the incident until primary restoration is completed and the turtles are back to baseline. The principal concept underlying the service-to-service approach is that the public can be compensated for past losses of natural resources and services through projects that provide additional resources of the same type and quality and of comparable value. To accomplish this, the method takes into account the amount of services lost over time and the amount of replacement services to be provided in the future. The size of the replacement project is selected so that the quantity of services provided by the replacement project is equivalent to the quantity of services lost due to the injury. The quantities are calculated in discounted terms, where the discounting reflects the observation that people place greater value on having resources available in the present than on having availability delayed to a future point in time.

The Trustees determined the interim loss of turtle services using information on the sea turtle injury and the primary restoration requirement. The loss of an equivalent of 8,157 hatchlings occurred in the year 2000. Primary restoration has to produce 2,719 hatchlings each year of three years to get back to baseline. The interim loss that occurs from the time of the injury until recovery to baseline in 2005 totals 23,000.5 discounted hatchling-years, where a hatchling-year is defined as the flow of services from a hatchling for one year.[14] [15] The scale of compensatory restoration is the additional number of hatchlings to save each year that provides the 23,000.5 hatchling-years that were lost.

The parameters that define the benefits of compensatory restoration are the same ones that characterize primary restoration, i.e., compensatory restoration is to occur over three years starting in 2003. The one other parameter that is needed is the maximum expected lifetime of sea turtles, which is estimated as seventy-five years based on earlier work done for the case (Jeansonne, 2002b). The discounted hatchling-years supported by one additional hatchling in each year of a three-year project total 81.27.[16] In order to compensate for the interim loss

[13] It assumed primary restoration would begin in 2003.

[14] Services are discounted at three percent, the social rate of time preference or the rate at which society is willing to substitute between present and past consumption of natural resources and services.

[15] For further information on the quantification of interim losses, see Penn, 2002b.

[16] For further information on the quantification of compensatory restoration benefit, see Penn, 2002b.

(23,000.5 hatchling-years), the restoration program must provide an additional 283 hatchlings per year (23,000.5/81.27).

Adding the primary and compensatory restoration components together, the restoration must provide 3,002 hatchlings (2,719 + 283) per year for each year of a three-year program to offset all of the sea turtle losses.

The restoration requirement is achieved by implementing the lighting enforcement projects in Brevard and Palm Beach Counties for a three-year period. In Palm Beach County, officials estimate that 22,100 hatchlings a year are at risk of disorientation.[17] In Brevard County, 47,000 hatchlings are at risk each year.[18] Brevard County predicts that through surveys, reporting of non-compliant lights, and enforcement action it can reduce the lighting problem and hatchling disorientation by 5% (Barker, 2002). The benefit is 2,350 hatchlings saved per year. In Palm Beach County, it is expected that enforcement can also reduce hatchling disorientation by 5%. Turtle hatchlings saved per year would total 1,100. Between the two Counties, 3,450 hatchlings would be saved annually. Implementing an enforcement project in only one County for three years does not save enough hatchlings nor does implementing the projects in both Counties for a fewer number of years.

3.4.2.4 Monitoring Plan for Sea Turtle Restoration

Specific monitoring actions would not be required for the proposed lighting enforcement projects. However, in order to measure the success of the projects, Palm Beach and Brevard Counties would be required to prepare a report at the end of each nesting season that details enforcement actions undertaken and presents the results to the Trustees. The report would also include a comparison of the number of disorientation events for that season compared to events from previous seasons in order to measure the effect of lighting enforcement projects.

3.5 Water Column Injury and Restoration Plan

3.5.1 Injury Determination and Quantification

3.5.1.1 Description of the Injury

The incident, based on hindcasting of the timing and path of the oil, resulted in water column concentrations of polycyclic aromatic hydrocarbons (PAH) that are known to be toxic to aquatic organisms in laboratory tests. Exposure of the water column biota, as calculated by the SIMAP model, would be distributed within a large volume of ocean water, and not readily observed or measured due to its extremely ephemeral nature. The oiled and injured organisms (predominantly small fishes and invertebrates) would be expected to be eaten by foraging fishes

---

[17] This is based on 9,191 nests in the enforcement area with 80 hatchlings per nest and a 3 percent hatchling disorientation rate (Davis, 2002b).

[18] This is based on 19,610 nests in the enforcement area (Barker, 2002).

and seabirds, decompose rapidly, or be transported by the Gulf Stream current out of the area. Thus, direct observation of the water column injury was unlikely.

3.5.1.2 Injury Quantification

Injury to the water column biota, primarily fishes and some invertebrates, was calculated using SIMAP, a computer based model. Based on biological resources in the area of the incident and toxicity data, SIMAP calculated the direct kill of fish and invertebrates. In addition to the direct kill, there is a loss of future productivity from the fish and invertebrates that were killed.[19] SIMAP computed the normal production (as net somatic growth) expected from the killed organisms and summed those losses over predicted life-spans. The direct kill and the foregone production were quantified as the total biomass lost.[20] Total biomass loss is calculated using the number of fish killed by age class and species, standard fisheries equations of length versus age, and weight versus length, and survival, mortality, and growth rate determinations. The fish and invertebrate biomass loss resulting from the incident totaled 10,930 kilograms wet weight (French-McCay et al., 2001). Appendix E presents the fish and invertebrate injury quantification section of the SIMAP report.

3.5.2 Water Column Restoration Planning

3.5.2.1 Preferred Primary Restoration Alternative

The water column resource injuries are expected to recover rapidly and naturally due to fish and invertebrate reproductive recruitment potential. The Trustees believe that production from unaffected organisms and recruitment from tributaries and other areas of the Atlantic Ocean will provide sufficient egg and young production to sustain populations of fish injured by the incident. Therefore, the Trustees selected natural recovery as the preferred primary restoration alternative.

3.5.2.2 Preferred Compensatory Restoration Alternatives

The Trustees selected mangrove restoration as the preferred alternative to produce compensatory fish and invertebrate biomass.

1. Mangrove Restoration: Mangroves support fish and invertebrate production and, through the restoration of this habitat, the Trustees can provide the fish and invertebrate biomass that was lost. The amount of restoration required to offset the fish biomass losses is determined based on literature estimates of secondary productivity. Two sites considered for mangrove habitat creation are the

[19] The impact on each species is relatively small compared to the total population so changes in natural and fishing mortality of surviving animals are assumed not to compensate for the killed animals during the natural lifespan of the animals killed (French-McCay et al., 2001).

[20] Because the number of organisms affected are relatively small portions of the total reproductive stock, sufficient eggs will be produced to replace the lost animals in the next generation (French McCay et al., 2001).

north end of Virginia Key in Dade County and the St. Lucie Inlet State Preserve in Martin County. The Trustees considered sites in Broward County for mangrove restoration, including West Lake Park, which is a 1,500-acre County-managed/State-owned park comprised largely of mangrove habitat. Restoration of mangrove is already being planned for the Park and other opportunities for restoration in the Park and elsewhere in the County (e.g., John U. Lloyd State Park) are being reserved for future mitigation purposes.

3.5.2.3 Non-Preferred Compensatory Restoration Alternatives

1. Natural Recovery: There is an interim loss associated with the water column injury: the fish and invertebrates that were lost and their production forgone will not be restored through natural recovery. Compensatory restoration is necessary to provide the biomass that was lost.

2. Seagrass Restoration: Seagrasses can also provide the compensatory fish and invertebrate biomass. The Trustees determine the amount of seagrass restoration that would be required to offset the fish biomass losses using literature estimates of seagrass productivity and function, i.e., how seagrass habitats lead to production of fish and invertebrate biomass through habitat and food chain processes. There are seagrass restoration opportunities in Dade County (Biscayne Bay) and points further south. The Trustees also considered West Lake Park for seagrass restoration. While new seagrass beds could be established, the success is not certain because they would be in waters where water clarity could be problematic.

3. Reef Restoration: Another way to provide fisheries biomass is to create or restore reefs and reef communities that support fisheries production. Broward County has an established artificial reef program; reefs are made of materials including limestone and engineered concrete modules, which are deployed offshore of Broward County at various ocean depths. The Trustees are considering something similar in this case for fish biomass restoration. There are studies in the literature that document the fish productivity value of such actions.

Evaluation of Compensatory Restoration Options and Environmental Consequences

It is well recognized in the ecological sciences that mangrove habitat contributes to the production of fish and invertebrate biomass, which satisfies the goal of compensatory restoration. Mangrove habitat creation is likely to succeed as it has been successfully implemented in various locations, including Florida. Mangrove would be created by scraping down unproductive upland habitat, dominated by exotics, to appropriate elevations for mangrove growth. While this project would involve habitat conversion, the Trustees do not believe that this conversion would cause collateral injury. In fact, mangrove creation benefits other resources injured by the incident by providing roosting and nesting habitat for seabirds, including cormorants. Mangrove restoration is not expected to have any effects, positive or negative, on public health and safety; however the alternative is consistent with natural resource management plans, including plans for exotic plant removal, shoreline erosion protection, and shoreline habitat restoration. Based upon past trustee restoration experience, mangrove habitat creation costs on average $30,000 per acre, excluding oversight and monitoring costs.

Like mangroves, seagrasses also contribute to the production of fish and invertebrate biomass. They also provide benefits to other resources, including sea turtles and manatees, which use seagrasses mostly for foraging. There is some question whether seagrass can be created and/or restored in the area of Florida affected by the incident, however. Poor water clarity is one of the primary limiting factors. Seagrass restoration can be successful in seagrass beds denuded by boat propellers or groundings, but opportunities for this type of restoration are generally limited to extreme southern Florida. The restoration of denuded areas would be a conversion of bare sea floor into seagrass habitat so there would be no associated collateral injury. Seagrass restoration is consistent with natural resource management plans and the Trustees do not anticipate seagrass restoration to have any effect on public health and safety. The Trustees have restored seagrass beds impacted by boat propellers and groundings in other natural resource damage assessment cases in south Florida; based on that experience, the Trustees estimate restoration to cost approximately $220,000 per acre.

Artificial reef is another habitat capable of producing compensatory fish and invertebrate biomass. Fishery productivity of artificial reefs in Florida was recently estimated for another natural resource damage assessment case. Broward County has an artificial reef program that has created numerous reefs offshore from the beaches impacted by the incident. Therefore, this type of restoration can be implemented and it is consistent with County management plans. Because of the numerous reefs offshore of Broward County, there is some question whether additional reef would be beneficial in this area. Artificial reef construction would convert sandy or silty ocean bottom habitat; however, the Trustees do not consider this conversion to be a collateral injury; the ocean bottom offshore is not a limited resource. An artificial reef, depending on placement, could provide recreational diving or snorkeling opportunities. While these opportunities are an added benefit of reef restoration, artificial reefs do pose some risk of injury to humans who swim, dive, or snorkel on them. The Trustees estimate the costs of artificial reef to be about $200,000 per acre based on past restoration experience.

3.5.2.4 Preferred Alternative

Based upon the above analysis, the Trustees selected mangrove habitat creation as the preferred restoration alternative to compensate for fishery biomass and production lost as a result of the incident. Mangrove habitat creation is much more certain to be successful than seagrass and artificial reef habitat creation, and is a cost-effective alternative. The mangrove alternative could also benefit other resources, and would provide the incidental benefit of removal of problematic exotic plant species.

Project Selection

The Trustees considered two sites for mangrove restoration: Virginia Key and St. Lucie Inlet State Preserve. The proposed area of restoration on Virginia Key is situated between the water treatment facility and the west shoreline of the Key where there are over eighteen acres available for restoration. The elevation of the area ranges from one to eight feet above the mean high tide mark with exotics invading 30% to 65% of any given area. To enable successful mangrove restoration, some areas would have to be scraped down, exotics would have to be removed, and mangroves would have to be planted. Because of the location of the water treatment facility,

heavy equipment and hauling trucks could easily access the site. There is also an area on the Key for possible disposal of the removed soil, pending city approval.

St. Lucie Inlet State Preserve is located at the north end of Hutchinson Island; the preserve is only accessible by vessel. There are two areas within the preserve identified for restoration. One area is eight acres and has elevations ranging from eight to twenty-plus feet above the mean high tide mark. The exotic invasion ranges from 90% to 100%. The other area is four acres and has elevations between one and eight feet above the mean high tide mark; the exotic invasion varies between 30% and 65% in any given area. As with the Virginia Key project, successful mangrove restoration in these areas would require scrape down, exotics removal, and mangrove planting. Due to the remoteness of the preserve, heavy equipment would have to be transported via barge and any removed fill would have to be transported off site via barge. No disposal site for the removed soil has been identified.

The Trustees are proposing the Virginia Key site for restoration. The Trustees recognize both proposed sites, Virginia Key and St. Lucie Inlet Preserve, would have similar ecological value if restored. However, the inaccessibility of St. Lucie Inlet Preserve would result in high initial startup costs of mobilizing equipment and personnel. The higher elevation area of the St. Lucie Inlet Preserve would also require a large amount of excavation and exotic removal, resulting in extremely high operational and disposal costs. The Virginia Key site is easily accessible and is expected to have low operational and disposal costs. Given the lower costs, with similar ecological benefits, the Trustees prefer the Virginia Key site for mangrove restoration. The project would be implemented by the County through an agreement with the Trustees.

Restoration Scaling

The Trustees used a service-to-service scaling approach to determine the mangrove compensatory restoration project scale. The same concepts of service-to-service scaling that were described earlier apply here as well. In this case, the size of the mangrove habitat project is selected so that the biomass of fish and invertebrates provided by the habitat is equivalent to the biomass that was lost due to the injury. The mangrove project has to provide 10,930 kilograms of fish and invertebrate biomass in order to compensate for the loss.

To be able to determine restoration scale, the Trustees had to identify a number of parameters that characterize mangrove restoration. A study of mangrove habitats from the southern Gulf of Mexico calculated that 12 grams of fish and invertebrates are produced per square meter of mangrove habitat per year (Yanez-Arancibia et al., 1980). Because created mangroves do not provide full services immediately after construction and they may not function as well as natural mangroves, the Trustees have to adjust the annual estimate of production over time. Michel (2001) conducted a review of the literature on mangrove function; she found little published data on fishery habitat value and services of restored mangroves. One study that evaluated four mangrove sites indicated that comparable fish communities were established in three to five years. In another study, fish and shrimp density in a replanted mangrove was as high as that of natural mangroves after five years. The Trustees determined that a created mangrove would mature, linearly, over five years and achieve the productivity of 12.0 grams per square meter per

year.[21] The created mangrove is expected to support fish productivity for 50 years. Michel investigated the longevity of mangroves and found that some stands have survived for 70 years or more; however, mitigating this longevity are changing environmental conditions including hurricanes and tropical storms, which are common in South Florida.

These parameters determine the biomass produced over the course of the mangrove's expected lifetime. One acre of mangrove produces a discounted biomass of 1,091 kilograms (using a three percent discount rate). In order to provide the biomass that was lost, the constructed mangrove would have to be 10.0 acres (10,930/1,091).[22]

3.5.2.5 Monitoring Plan for Water Column Restoration

Monitoring of the mangrove restoration would be necessary to evaluate project success. The Trustees propose semi-annual monitoring for a period of five years. The vegetative monitoring would consist of six randomly located transects, utilizing the line intercept methodology, and semi-annual observations within (3) one square meter fixed grids, every ten meters along the transects. The following detailed observations would be recorded at each monitoring grid, along each transect: species, plant height, diameter at breast height (if applicable), and presence of prop roots. The results of the monitoring events would be presented to the Trustees in report form.

Based on the results of the monitoring reports that indicate mangrove health, the Trustees would determine the need for corrective actions that would promote project success. Corrective actions could include additional removal of exotic vegetation, creation or clearing of tidal channels, or additional planting of mangroves. After five years of monitoring and potential corrective actions, the mangroves are expected to be established and self-sustaining.

3.6 Bird Injury and Restoration Plan

3.6.1 Injury Determination and Quantification

3.6.1.1 Description of the Injury

The SIMAP indicates that seabirds, mostly cormorants, were exposed to a surface oil slick. Birds that were exposed were expected to suffer sub-lethal injury or death due to a combination of smothering and toxicity. Two oiled brown pelicans were collected and brought to a wildlife rehabilitation facility (Jeansonne, 2000). Operations during the incident documented the sighting of other live oiled birds. The small number of birds calculated to have been exposed and killed (see below) would be expected to go largely unobserved (Ford et al., 2001).

[21] The Trustees did not find any information on the shape of the maturity curve. In absence of data, a linear shape approximates the true curve.

[22] For further information on the quantification of compensatory restoration scale, see Penn, 2002b

3.6.1.2 Injury Quantification

The Trustees used SIMAP to quantify the injury to birds. SIMAP calculated the number of exposed birds based on the area affected by the incident and the number and type of birds expected within that area. The model converts sub-lethal injury to a smaller number of birds killed. The calculated injury is twelve birds, primarily cormorants and brown pelicans (French-McCay et al., 2001 – see Appendix D for further information). As with the water column impacts, the impact on local bird abundances is relatively small compared to the total population so changes in mortality of surviving birds are assumed not to compensate for the killed animals during the natural lifespan of the animals killed. It is assumed that these birds were fully-grown so there would have been no additional production from weight gain over their lifetime; thus, there is not a production foregone injury component.[23]

3.6.2 Bird Restoration Planning

3.6.2.1 Preferred Primary Restoration Alternative

The Trustees expect the natural reproductive potential of unaffected organisms to support the species of birds injured by the incident. In other words, it is expected that the birds will be back to baseline in one generation through natural reproductive processes. Therefore, the Trustees selected natural recovery as the preferred alternative.

3.6.2.2 Preferred Compensatory Restoration Alternative

What is not replaced through natural recovery are the birds that were killed. So, there is an interim loss and compensatory restoration is necessary to replace the birds that were lost. The Trustees considered the following alternatives as compensatory restoration for the bird injury.

1. Education Signage: The Trustees considered education signage as a way to prevent seabird mortality and restore the seabirds that were lost. Seabirds often become entangled in monofilament fishing line or caught on fishing hooks. If they cannot free themselves, they die. By posting signs at fishing piers that warn anglers against cutting their lines and demonstrate how to free birds from fishing lines and hooks, the signs can prevent entanglement and provide seabird rescue in the event of entanglement. The signs also have a local phone number to call for wildlife rescue assistance. This type of restoration has been successfully implemented at fishing structures in the Tampa Bay area by Save Our Seabirds, Inc. There are opportunities to post signs in Broward County, including at the fishing structures at John U. Lloyd State Park and Dania Beach.

3.6.2.3 Non-Preferred Compensatory Restoration Alternative

1. Natural Recovery: There is an interim loss associated with the bird injury. However, the birds that were lost are not replaced through natural recovery. Therefore, the Trustees could not select natural recovery as a preferred compensatory restoration alternative.

[23] As with the water column injury, there is also no reproductive loss component.

2. Mangrove Restoration: The Trustees considered mangrove restoration as a way to restore the birds that were lost due to the incident. In addition to supporting fish and invertebrate production, mangrove habitat supports bird productivity through provision of nest sites and other services. As indicated above, there are mangrove restoration opportunities in Dade and Palm Beach Counties. The amount of restoration required to offset the bird losses can be determined based on literature estimates of mangrove secondary production.

3. Rehabilitation: Providing funds for bird rehabilitation facilities is another way to restore seabirds. To be a feasible restoration alternative, the facilities have to be resource-limited so that restoration dollars result in additional birds saved or restored. The Trustees discovered that there are bird rehabilitation facilities in need of funding, including Tri-State Bird and Rescue.

Evaluation of Compensatory Restoration Options and Environmental Consequences

Education signs meet the restoration goal of replacing the lost birds by saving birds from injury and death by entanglement in fishing line. Signs typically have a seven-year lifetime so the restoration goals would be met quickly through this alternative. Installation of bird signs and the resulting increase in successful rescues have occurred at fishing piers in Florida, particularly in the Tampa Bay area. There are piers available for signs in Broward County, which is the area of the bird injury. In addition to preventing bird entanglement, the bird signs can also benefit other natural resources, including sea turtles that have been documented to become entangled in fishing line. The Trustees do not expect any collateral injury to natural resources resulting from the bird signs. The education signs, which demonstrate how to free birds that are entangled, may indirectly result in injury to humans by encouraging them to handle wild birds, but on the other hand these signs prevent human injury by instructing people on the proper handling of wild birds. There are no management plans that are applicable to the bird signs. Based on the costs of sign construction and installation in the Tampa Bay area, the cost of signs for one fishing structure is approximately $1,000.

Mangrove habitat creation can produce bird services by providing a source of bird food and nest sites; this alternative meets the restoration goals by providing the bird biomass that was lost.[24] As discussed under the water column injury, mangrove habitat creation is a well-developed, successful restoration technology. In addition, mangroves benefit a variety of resources without causing any collateral natural resource injury or impacting public health and safety. Also, mangrove creation is consistent with a variety of natural resource management plans, as mentioned above. To reiterate, mangrove creation generally costs around $30,000 per acre.

Providing additional funding to a seabird rescue and rehabilitation organization would directly replace seabirds by preventing mortality of birds injured by a variety of causes. Seabird rescue and rehabilitation facilities have operated for years throughout the United States, which makes this alternative feasible and likely to succeed. The Trustees do not expect that funding a rehabilitation facility would cause collateral natural resource injury, benefit more than one

[24] The amount of mangrove required to compensate for the bird impacts would be based on mangrove primary production that supports birds. Because a unit of primary production energy cannot support both birds and fish at the same time, mangrove restoration for the bird injury would be in addition to that required for the water column injuries.

natural resource, or impact public health and safety. There are no management plans that are applicable for this alternative. The Trustees estimate the cost per bird saved at a rehabilitation facility in south Florida to be approximately $370.

3.6.2.4 Preferred Alternative

Based upon the above analysis, the Trustees selected installation of bird rescue signs on a fishing pier as their preferred restoration alternative. This alternative has a documented record of success, is cost-effective, would replace the lost birds relatively quickly, and could indirectly benefit a range of other injured wildlife.

Project Selection

The Trustees considered two locations for bird signs, Dania Beach pier and the John U. Lloyd State Park jetty. The Trustees propose to install signs at Dania Beach and then at the Park jetty, if necessary depending on the amount of restoration required.

The pier at Dania Beach is a large structure that attracts both anglers and birds, thus this location provides the best opportunity to save seabirds. The Dania Beach pier is located just south of John U. Lloyd State Recreation Area. The pier attracts many diving and skimming birds that are susceptible to various hazards associated with fishing activities. Hazards can include entanglement in monofilament line, snagging by hooks and feeding on rigged bait. To educate the public on prevention, handling, and rescue of impacted birds, signs would be posted strategically on the pier. The signs would also provide a phone number to the Wildlife Care Center for emergency assistance. The Wildlife Care Center, a not-for-profit organization, has been in existence for thirty-three years in Fort Lauderdale. This project would be implemented in cooperation with the pier owner and the Wildlife Care Center.

Restoration Scale

The Trustees used a service-to-service scaling approach to determine the bird signage compensatory restoration project scale. Again, the same concepts of service-to-service scaling that were described earlier apply. Here, the size of the signage project is selected so that the quantity of birds provided by the project is equivalent to the quantity of birds lost due to the injury (12 birds).

There are several parameters that are needed in order to characterize the benefits of bird signs, including the number of birds saved per sign installed and the longevity of the signs. To help identify these parameters, the Trustees contacted Lee Fox of Save Our Seabirds (SOS), Inc., a non-profit group that has sponsored and installed signs for the purpose of preventing seabird mortality from being hooked and/or entangled. During the course of one year, Fox reported the number of rescue calls fielded by SOS was twenty in response to thirty-five large signs posted at seven piers throughout Pinellas County, Florida[25] (Fox, 2002). So, the number of responses, or

[25] Note, the education signs have an emergency contact number for people who need assistance with bird rescue. Because there are those who rescue birds without assistance, the birds saved per sign installed will be a lower bound estimate.

birds saved, per large sign is 0.571. The SOS signs are Department of Transportation regulation signs and have a lifetime of five to seven years. The Trustees expect the signs installed for this project would last for seven years.

These parameters determine the birds saved per sign installed. One sign would save 3.36 birds over a seven-year period (after discounting using a three percent rate). In order to save the number of birds that were lost, there must be 3.6, or 4, signs installed.[26] Lee Fox suggests constructing three or four signs per fishing structure, one at the beginning, two in the middle, and one at the end of the structure. Along with each larger sign, Fox installs two smaller rail signs (Fox, 2002). Thus, to offset the bird impacts, the Trustees have to sign one fishing structure, the Dania Beach pier, requiring four large signs and eight smaller rail signs.

3.6.2.5 Monitoring Plan for Bird Restoration

There is no monitoring plan for the bird restoration. The signs are being installed in a location of recreational fishing activity and seabird presence. Also, once installed, the signs should serve their purpose without additional requirements. Therefore, no additional effort and funds are needed to ensure that the projects are effective.

3.7 Summary of Restoration Planning

The Trustees are proposing a number of restoration actions in response to the mystery incident. Sea oat plantings, dune walkovers, shade areas, and handicapped carts at affected beaches in Broward County are being proposed to compensate for lost beach use. Augmenting lighting ordinance enforcement in Brevard and Palm Beach Counties, which would save future hatchlings from disorientation, is proposed to return sea turtles to baseline and to compensate for interim losses. The Trustees propose to create 10 acres of mangroves on Virginia Key to produce the fish and invertebrate biomass that was lost. Education signs that would prevent seabird entanglement and enable seabird rescue are proposed for the Dania Beach pier in order to replace the birds that were killed.

The costs of restoration are what become part of a natural resource damages claim. The Trustees have not prepared a detailed estimate of restoration costs (and monitoring where applicable) in case the plans for restoration change between this draft document and the final plan. The detailed cost estimates of restoration will be prepared by the Trustees once the restoration plan is finalized. These restoration costs will be presented to the Federal Oil Spill Liability Trust Fund for payment.

3.8 Assessment Costs

The Trustees have proposed restoration to compensate for the natural resource and service injuries. In addition to recovering the costs of restoration, OPA provides for the Trustees to identify and recover their costs of conducting the natural resource damage assessment. The

---

[26] For further information on the quantification of compensatory restoration scale, see Penn, 2002b.

Trustees have incurred costs from performing the assessment and expect to incur additional costs before finalizing the assessment. These past and anticipated costs will be presented to the Federal Oil Spill Liability Trust Fund at the time the Trustees submit their full restoration claim for payment.

3.9 Restoration Oversight and Administrative Costs

Once the restoration projects are implemented, the Trustees oversee the projects by reviewing monitoring reports and determining whether corrective actions are necessary. The Trustees also engage in other actions to administer the case during this period, including documenting what a trustee spends on the project each year. The costs of these activities are another part of the cost of restoration and they will be included in the claim that the Trustees submit to the Federal Oil Spill Liability Trust Fund.

4.0 Compliance with Applicable Laws and Regulations

Implementation of the Trustees' preferred restoration alternatives is subject to the requirements of laws and regulations, in addition to the Oil Pollution Act, relating to environmental protection and the safe use of waterways, among other things. This section discusses the specific requirements and prohibitions of several laws that are likely applicable to the proposed projects, as well as the procedures that Trustees are required to follow in complying with these laws.

Some laws, such as the National Environmental Policy Act and the Coastal Zone Management Act, require that the Trustees certify to appropriate regulatory agencies, prior to reaching a final decision to fund, approve, or implement the projects, that the projects will not violate the law in question. For these laws, the Trustees have or will forward this Draft Damage Assessment and Restoration Plan and Environmental Assessment to the oversight agency with the Trustees' determination and certification of compliance. Any comments, questions, or requirements for project implementation identified by these agencies will be incorporated into the Final Damage Assessment and Restoration Plan.

The requirements for compliance with other laws, such as the Clean Water Act, can only be determined at the time that the Trustees or those implementing the projects apply for a restoration construction permit with the applicable regulatory agency. However, the general policies and prohibitions of these laws are described in the following sections.

Applicable State laws are summarized in the Coastal Zone Management Act section, and compliance with these laws will be ensured through the consistency determination and review process.

4.1 National Environmental Policy Act: Draft Analysis of Significance of Impacts

Pursuant to the National Environmental Policy Act (NEPA), 42 U.S.C. § 4321 *et seq.*, and the implementing regulations at 40 CFR Part 1500, Federal agencies contemplating implementation of a major Federal action must produce an environmental impact statement (EIS) if the action is

expected to have significant impacts on the quality of the human environment. Federal agencies may conduct an environmental assessment (EA) to evaluate the need for an EIS. If the EA determines that the proposed action will not significantly impact the quality of the human environment, the agency issues a Finding of No Significant Impact, and thus satisfies the requirements of NEPA. NEPA defines the human environment comprehensively to include the "natural and physical environment and the relationship of people with that environment." 40 CFR Section 1508.14. All reasonably foreseeable direct and indirect effects of implementing the project, including beneficial effects, must be evaluated by the Federal agency. 40 CFR Section 1508.8.

Section 1508.27 of the NEPA regulations describes the minimum factors that Federal agencies should consider in evaluating the potential significance of proposed actions. The regulations explain that significance embodies considerations of both context and intensity. In the case of site-specific actions such as mangrove habitat creation proposed in this Draft DARP/EA, the appropriate context for considering potential significance of the action is local, as opposed to national or world-wide. However, the national significance of projects designed to address injuries to Federally listed threatened and endangered sea turtles must be considered in evaluating those restoration alternatives and their potential consequences.

With respect to intensity of the impacts of the proposed action, the NEPA regulations suggest consideration of ten factors:

(1) likely impacts of the proposed projects;

(2) likely effects of the projects on public health and safety;

(3) unique characteristics of the geographic area in which the projects are to be implemented;

(4) controversial aspects of the project or its likely effects;

(5) degree to which possible effects of implementing the project are highly uncertain or involve unknown risks;

(6) precedential effect of the project on future actions that may significantly affect the human environment;

(7) possible significance of cumulative impacts from implementing this and other similar projects;

(8) effects of the project on National Historic Places, or likely impacts to significant cultural, scientific or historic resources;

(9) degree to which the project may adversely affect endangered or threatened species or their critical habitat; and

(10) likely violations of environmental protection laws.

These factors, and the Federal Trustees' preliminary conclusions concerning the likely significance of impacts of the proposed projects, are discussed in detail below for each of the proposed restoration actions.

4.1.1 Beach Use Injury: Sea Oat Planting, Dune Walkover Installation, Provision of Beach Shade Areas and Provision of Beach Carts for the Handicapped

Nature of likely impacts. Sea oats will be planted on existing dunes that are either unvegetated or have lost vegetation due to storms, or in sand areas where planting of sea oats is likely to encourage dune formation. The end result of either approach will be to retard erosion of beaches by retaining sand on the beaches. Sea oats may provide collateral benefits to other natural resources, such as habitat for birds and lizards, and nesting material for birds. Dune walkovers will protect dunes from the effects of human foot travel, thus also preventing erosion as above. Protected dunes and more stable beaches may also have collateral benefits for sea turtles; turtles often like to nest right up against dunes. Shade areas will increase the quality of beach visitation for sun-sensitive persons. Where trees will be planted to provide shade, this project will provide some level of natural resources services, such as roosting areas or food for birds. Beach carts for handicapped persons are specially designed to provide easy mobility across sand, and thus will provide access to the beach that may not have previously been available for some persons.

Effects on public health and safety. These projects are expected to have beneficial impacts on human health and safety. Beaches are the first line of defense of upland property and development from storms and erosional forces. Beach dunes make a beach more of a buffer against wind and water impacts to uplands. Shade areas can help reduce skin sun damage in people. The handicapped carts will allow physically challenged individuals to more fully enjoy the beaches.

Unique characteristics of the geographic area. The beach areas that will be affected by the projects are typical of south Florida Atlantic beaches.

Controversial aspects of the project or its effects. Sea oat planting can be controversial if it is implemented in such a way as to obscure the views of beachfront residents. However, the sites proposed for sea oat planting under this restoration plan have been specifically selected by managers of the subject beaches for, among other things, lack of controversy; some of the projects include re-planting of sea oats that had been lost due to erosion. The Trustees know of no controversy associated with installation of dune walkovers or shade areas, or provision of beach carts for the handicapped.

Uncertain effects or unknown risks. All of the proposed projects have been implemented numerous times on beaches throughout Florida – in fact, the suggestions for the projects came from beach and park managers who have had experience with these types of activities or structures. Thus, the Trustees do not believe there are any uncertain adverse effects or unknown adverse risks associated with implementing these projects. The Trustees understand the risk that severe storms may shorten the life of planted sea oats and the dunes that they protect.

Precedential effects of implementing the project. As discussed above, the proposed projects have been implemented on beaches throughout Florida, and in some cases have been previously implemented on some of the same beaches targeted for the restoration actions. Thus, these projects will have no precedential effects.

Possible significant, cumulative impacts. The Trustees do not believe that the beach use restoration projects will have any significant, cumulative adverse impacts. Sea oat planting and dune walkovers will be implemented on beaches that wage a constant battle with erosional forces, thus they will assist in the State's extensive, perennial efforts to maintain these beaches through measures including renourishment. Shade provision and provision of carts for the handicapped are relatively minor components of the restoration effort and will not result in any negative cumulative impacts to beach use.

Effects on National Historic Sites or nationally significant cultural, scientific or historic resources. There are no discovered National Historic Sites, or nationally significant cultural, scientific, or historic resources in the areas in which the projects will be implemented. However, historic preservation experts inform the Trustees that the entire Broward County shoreline should be considered as likely to contain undiscovered cultural or historic resources or sites – resources that could be impacted through digging that may be associated with sea oat planting, dune walkover installation, or shade tree planting. Through consultations with State and Federal historic preservation officers, the Trustees will determine how to implement the restoration projects without adversely affecting cultural and historic resources.

Effects on endangered or threatened species. Sea oats and shade areas will be located in zones of the beach that are not used by sea turtles for nesting, and will not be constructed during turtle nesting season. Similarly, sea turtles do not nest in dunes that will be protected by installation of walkovers, which will also be installed outside of turtle nesting seasons. Anecdotally, the sea oat plantings and dune walkovers should benefit endangered and threatened sea turtles, by protecting the subject beaches from erosion, making the beaches more sandy and thus more suitable for nesting. Beach access carts for the handicapped will have no impacts on endangered or threatened turtles.

Violation of environmental protection laws. No environmental protection laws will be violated during the implementation of these projects. It is a requirement of the OPA NRDA regulations that restoration alternatives considered be capable of being implemented in compliance with all applicable laws and regulations.

Preliminary conclusion. The beach restoration projects will add to the quality of beach use experience by assisting in retaining sand on beaches subject to erosion, by providing shade for sun sensitive persons, and providing freedom of access to the beaches for handicapped persons. Though beneficial, none of these effects are judged to be significant, as defined by NEPA.

4.1.2 Sea Turtle Injury: Augmented Enforcement of Lighting Ordinances

Nature of likely impacts. Enforcement of lighting ordinances will require beach-front residents and businesses to convert problem lighting to one of several types of lighting that have been approved as both turtle-friendly and safe and effective for the needs of the particular type of structure. Brevard County's years of experience enforcing its lighting ordinance demonstrates the reduction in disorientation, and thus death, of emerging sea turtle hatchlings associated with conversion of problem light sources. Reduced artificial lighting after dark will have similar beneficial effects on other nocturnal species, including bats, moths, raccoons, and others.

Effects on public health and safety. The types of lights that will be required to be installed to replace lights associated with turtle hatchling disorientation should have no detrimental effects on public health and safety.

Unique characteristics of the geographic area. See discussion above under beach use projects.

Controversial aspects of the project or its effects. The Counties that will receive the funding to implement the turtle lighting conversion projects are highly enthusiastic about the projects and their demonstrated success in their Counties and in other areas. Conversion of problem lighting on residences and businesses may be controversial when it is first proposed and implemented in a particular County, but the vast majority of affected Florida residents and businesses seem to appreciate being able to help save turtles, once they learn that there are safe alternatives to problem lights.

Uncertain effects or unknown risks. Given that the ordinance enforcement programs that will be funded have been in force for several years, there are no measurable uncertain adverse effects or unknown adverse risks associated with these projects.

Precedential effects of implementing the project. There are no precedential effects of implementing the enforcement programs, because they have been previously implemented in south Florida locations. Lighting ordinances have been in effect in Palm Beach County since 1989.

Possible significant, cumulative impacts. The enforcement programs will add to the benefits of ongoing turtle-friendly lighting activities in the Counties, by further decreasing the numbers of hatchlings disoriented by problem lights, and in that respect would be cumulative. The

incremental benefits due to the proposed restoration projects alone, however, is not considered significant, in targeting to save about 9,000 hatchlings over the course of three years.

Effects on National Historic Sites or nationally significant cultural, scientific or historic resources. There are no discovered National Historic Sites, or nationally significant cultural, scientific, or historic resources in the areas in which the projects will be implemented. Further, the nature of these projects, which will not involve digging or excavating, will pose no threat to undiscovered cultural or historic resources.

Effects on endangered or threatened species. The enforcement program projects will result in reduced numbers of hatchlings being disoriented and killed by attraction to artificial lights.

Violation of environmental protection laws. No environmental protection laws will be violated during the implementation of these projects. It is a requirement of the OPA NRDA regulations that restoration alternatives considered be capable of being implemented in compliance with all applicable laws and regulations.

Preliminary conclusion. The enforcement program projects will have beneficial impacts on hatchling sea turtles, by removing artificial light sources that cause hatchlings to crawl away from the ocean upon emergence from their nests, usually to their deaths. The projects will have collateral benefits on other nocturnal species that are hampered in their behavior, foraging or biorhythms by overly bright nighttime lights. The projects are designed to replace approximately 9,000 hatchlings over three years, which is a fraction of a year's total hatchling production on southeast Florida beaches. Thus, though wholly beneficial, the impacts of these projects are not judged to be significant, as defined by NEPA.

4.1.3 Water Column Injury: Mangrove Habitat Creation

Nature of likely impacts. This project will result in conversion of a combination of unvegetated uplands, and uplands heavily impacted by invasive species, into intertidal native mangrove habitat. Mangrove habitats are known for their support of fishery production (Yanez-Arancibia et al., 1980), and their importance to birds as roosting and nesting areas. The project can also be implemented so as to avoid any adverse environmental impacts to surrounding aquatic habitats, through control of any runoff of sediments during removal of soil to convert uplands into intertidal habitat. Thus, this project will result in a net improvement in natural resource services provision once implemented.

Effects on public health and safety. This project will have no effects on public health and safety, adverse or beneficial.

Unique characteristics of the geographic area. The area of Virginia Key that will be affected by the mangrove project is not unique.

Controversial aspects of the project or its effects. The Trustees know of no controversial aspects of the proposed project. Removal of exotic species is a priority throughout the State of Florida, and mangrove habitats are appreciated for their contribution to recreational fisheries. Moreover,

the project will be implemented in a location where the only controversial aspect of mangrove habitats – blocking of residential views – will not be at issue.

Uncertain effects or unknown risks. There are no uncertain adverse effects or unknown adverse risks associated with this project. Mangrove habitat creation is a long-established and successful technology and the Trustees have overseen several such projects in the past, including projects in Florida.

Precedential effects of implementing the project. There are no precedential effects of implementing the project, as mangrove habitat restoration is commonly implemented throughout Florida.

Possible significant, cumulative impacts. There are no adverse impacts expected from this project. The project size is small in scale relative to the extent of mangrove habitat in the area and in the region, thus no significant cumulative impacts are foreseen.

Effects on National Historic Sites or nationally significant cultural, scientific or historic resources. There are no discovered National Historic Sites, or nationally significant cultural, scientific, or historic resources in the areas in which the project will be implemented. However, from historic preservation experts from south Florida advise that coastal zones can be rich in undiscovered artifacts and sites. The Federal Clean Water Act and State environmental permits required for this project will entail consulting with historic preservation experts to ensure that the digging involved in implementing this project will ensure the protection and preservation of any historic or cultural resources found.

Effects on endangered or threatened species. The mangrove project on Virginia Key will have no adverse impacts on endangered or threatened species except possibly to support endangered and threatened fish and bird species.

Violation of environmental protection laws. No environmental protection laws will be violated during the implementation of these projects. It is a requirement of the OPA NRDA regulations that restoration alternatives considered be capable of being implemented in compliance with all applicable laws and regulations.

Preliminary conclusion. This project will beneficially convert upland habitat populated with invasive species into native intertidal mangrove habitat, thus enhancing the habitat's value for fishery and bird species. The project is small in scale, and thus its impacts are not judged to be significant, as defined by NEPA.

4.1.4 Bird Injury: Installation of Signs on Fishing Pier Instructing Anglers on Freeing Birds Hooked on Fishing Lines

Nature of likely impacts. This project will install a number of weather proof signs on a single fishing pier instructing anglers on how to free birds accidentally hooked on fishing lines, and providing a wildlife rescue service number to call in case an animal cannot be freed or is injured. These signs have been used in numerous places throughout Florida, and their designer, Save our

Seabirds, Inc., attests to their success from the number and types of calls they have received from people observing and using the signs (Fox, 2002). The only impact expected from this project is that fewer birds will perish from starvation or infection from unremoved fishing hooks and lengths of monofilament line.

Effects on public health and safety. The signs could place anglers in a position to be injured by birds' claws or beaks during a rescue attempt, but on the other hand the instructions provided on the signs can also prevent such injury. Thus, no net effect on public health or safety is anticipated.

Unique characteristics of the geographic area. The signs are to be placed on a fishing pier in Dania Beach, which is a typical south Atlantic Florida beach area.

Controversial aspects of the project or its effects. The Trustees do not believe there are any controversial aspects of this project, given the public's receptivity to and utilization of the signs in other places in Florida.

Uncertain effects or unknown risks. Given that the signs to be installed have been used in other fishing areas in Florida, the Trustees do not believe there are any uncertain effects or unknown risks associated with implementing this project.

Precedential effects of implementing the project. Again, because this type of project has been implemented in other areas in Florida, there will be no precedential effects of the project.

Possible significant, cumulative impacts. The project will consist of signing a single fishing pier, thus no cumulative impacts or benefits are expected.

Effects on National Historic Sites or nationally significant cultural, scientific or historic resources. The bird rescue signs will be installed on a man-made fishing pier, and will not impact any discovered or undiscovered significant cultural or historic resource.

Effects on endangered or threatened species. The project could result in the saving of any endangered or threatened bird species that accidentally gets hooked or tangled in fishing line near the signed fishing pier. Collateral benefits to injured sea turtles or manatees, or other listed species, may result from the inclusion of a wildlife rescue organization's number on the signs. Otherwise, no effects on endangered or threatened species will result from the project.

Violation of environmental protection laws. No environmental protection laws will be violated during the implementation of these projects. It is a requirement of the OPA NRDA regulations that restoration alternatives considered be capable of being implemented in compliance with all applicable laws and regulations.

Preliminary conclusion. Though beneficial to birds hooked or entangled in fishing gear near the pier to be signed, the impacts of the proposed project are not judged to be significant, as defined by NEPA.

4.2 Coastal Zone Management Act

The broad purpose of the Coastal Zone Management Act, 16 U.S.C. § 1451 *et seq.* (CZMA), which is administered by NOAA, is to preserve, protect, develop, and where possible, to restore or enhance the resources of the Nation's coastal zone for this and succeeding generations. States that produce acceptable coastal zone management plans are provided with financial assistance and authorized to review Federal activities within the State's coastal zone to ensure that these actions are consistent with the State's program. The States' plans identify permissible land and water uses, and their associated impacts on the regulated coastal zone.

Activities funded, approved, or implemented by Federal agencies and which will have an impact on State coastal zones must be consistent with the State's Coastal Zone Management Program and in particular with "enforceable policies" identified in their management plans. A certification of consistency by the Federal project proponent, and a concurrence from the affected State is required, in general no later than 90 days before final Federal approval of the activity. Florida's Final Coastal Management Program Plan was approved by NOAA in 1981. The Department of Community Affairs ("DCA") is the agency designated to conduct consistency reviews for the State of Florida.

NOAA reviewed the Florida Coastal Management Program Plan and identified several enforceable policies that are applicable to some or all of the proposed restoration actions. In analyzing these policies, consisting of chapters of the Florida Statutes, NOAA determined that the restoration projects proposed in this Draft DARP/EA are consistent with the FCMP. NOAA has submitted its consistency analysis along with this Draft DARP/EA to Florida DCA for its concurrence; DCA's concurrence must be obtained prior to finalizing this restoration plan. The relevant FCMP enforceable policies and their general purposes are as follows:

> Chapter 161 FS – Beach and Shore Preservation: these provisions regulate construction, reconstruction, and other physical activity in the coastal zone, and regulate actions for protection and preservation of the coastal zone, particularly from erosion. Installation of beach dune walkovers and planting of sea oats to stabilize sand dunes, both to prevent or retard beach erosion, are subject to regulation and permitting under these sections, and NOAA is confident that both these projects are consistent with the goals and policies of these statutes.
>
> Chapter 253 FS – State Lands: these provisions regulate the acquisition of land by the State, and the management, conservation, protection, disposition, and use of State-owned lands. Florida DEP is mandated to regulate land use in order to assure the maximum benefit and use for the general public. All of the proposed restoration projects will be implemented on, or will affect the use of, State-owned lands. The beach restoration projects will improve, enhance, and extend human use of public beaches by preventing or retarding beach erosion, and the mangrove habitat creation project will remove invasive species and create habitat that is supportive of recreational fisheries production.
>
> Chapter 258 FS – State Parks and Preserves: these provisions require the Division of Recreation and Parks to promote the State park system for the use, enjoyment and benefit

of the people of Florida and for visitors. The beach use projects planned for John U. Lloyd State Park and Hugh Taylor Birch State Park will improve or enhance the park and have the support of the Park Manager and the DEP Division of Recreation and Parks.

Chapter 370 FS – Saltwater Fisheries: these provisions require Florida Fish and Wildlife Conservation Commission to administer, develop and conserve marine fishery resources of the State, including through the protection and enhancement of the marine and estuarine environments and water quality. These provisions recognize the importance of marine commercial and recreational fishing, and the importance of protecting and conserving sea turtles and their habitat. The mangrove habitat restoration project was specifically selected to replace fishery resource production lost due to this incident. The sea oat planting projects will occur on turtle nesting beaches and thus will require DEP review under these sections; prevention of erosion on turtle-nesting beaches is consistent with the policies embodied by this chapter.

Chapter 372 FS – Wildlife: these provisions implement the State policy of conservation and wise use of freshwater fish and wildlife species, with particular emphasis on endangered and threatened species. The bird restoration project, to install signage educating fishers on how to save seabirds hooked or entangled in fishing line, will further the policies of this chapter.

Chapter 375 FS – Outdoor Recreation and Conservation: the applicable provisions of this chapter concern public use and benefit, now and into the future, pertaining to public beaches. All of the beach restoration projects – sea oat planting, dune walkovers, shade tree planting, and beach carts for the handicapped – will promote the policies of this chapter.

Chapter 376 FS – Pollutant Discharge Prevention and Removal: the policies and goals of this chapter are highly similar to those of the Federal Oil Pollution Act under which this restoration plan was developed. These provisions prohibit the discharge of pollutants, including oil, into or upon any coastal water, estuary, tidal flat, beach or lands adjoining the seacoast. Among other things DEP is directed to recover damages resulting from pollution discharges, for use to restore damaged natural resources to pre-discharge conditions. These provisions authorize basing the measure of damages on the cost of actions to restore injured resources when restoration is feasible. This Draft DARP/EA is fully consistent with the provisions of this chapter.

Chapter 403 FS – Environmental Control: these provisions regulate routine or expected discharges of pollution into the air and waters of the State. Permits may be issued for discharges that do not unacceptably degrade water quality and if the project is in the public interest. These provisions regulate dredge and fill projects, which includes the mangrove habitat creation project. Provisions of this chapter also recognize the importance of mangrove resources in the State, for their ecological, shore stabilization, and water quality functions.

Chapter 582 FS – Soil and Water Conservation: like other chapters of the Florida Statutes, these provisions are concerned with erosion and loss of soil resources in the State, and the impacts of soil erosion on water quality. The Broward County Soil and Water Conservation District ("BSWCD") was formed under the authorities of this section, and has been involved with beach erosion prevention projects in the County. BSWCD will implement the beach sea oat planting and shade tree planting projects under the direction of the Trustees, and in compliance with the provisions of this chapter and other provisions of Florida law.

4.3 Endangered Species Act

The purpose of the Endangered Species Act, 16 U.S.C. § 1531 *et seq.*, is to achieve conservation of endangered and threatened species, and the ecosystems upon which such species depend. All Federal agencies are required to insure that any action that they authorize, fund, or carry out is not likely to jeopardize the continued existence of any endangered or threatened species, or result in the destruction or adverse modification of habitat designated as critical for such species, unless the agency is granted an exemption for the proposed action. The Department of the Interior, through the Fish and Wildlife Service, has been delegated primary authority to oversee Federal compliance with the Endangered Species Act, though NOAA is delegated this responsibility for certain species including sea turtles when they are at sea.

If a Federal agency proponent of a project determines that a Federal threatened or endangered species may be in the action area of the project, the agency must consult with the Fish and Wildlife Service to ensure that implementing the project will not jeopardize the listed species. If the action agency demonstrates that the project does not constitute a "major construction activity," and the project will not adversely affect a listed species or its critical habitat, it submits a "no effect determination" to the Fish and Wildlife Service for its concurrence. If the project constitutes a major construction activity, then the action agency must prepare a biological assessment with a more in-depth evaluation of the potential effects of the project on the listed species, which may still lead to a no effect determination. If the project is likely to adversely affect either a listed species or its critical habitat, then more formal consultation procedures are required.

The Federally threatened loggerhead and endangered green and leatherback sea turtles are all known to nest on the beaches on which some of the proposed restoration projects will be implemented, or which will be affected by some of the restoration projects (the turtle hatchling protection and beach use projects). Endangered West Indian manatee may occur in waters around the proposed location of the mangrove habitat creation project. Several species of threatened or endangered birds may use habitats adjacent to the location of the mangrove restoration project. The proposed turtle lighting enforcement project will be conducted during turtle nesting season in and around residential development adjacent to turtle nesting beaches. This project will have only beneficial effects on listed turtle species. The sea oat planting, shade area provision, and dune walkover installation can all be implemented outside of turtle nesting and hatching seasons. The proposed shade areas will not be located within zones of the beaches used for nesting by turtles. The proposed sea oat planting and dune walkover projects will stabilize sand dunes that in turn stabilize the beaches upon which turtles nest. These proposed

projects will not reduce areas available for turtles to nest upon. The proposed mangrove habitat creation project will create new habitat available for use by birds. The project can also be implemented outside of the nesting seasons of any of the listed species. The mangrove project is not expected to impact the West Indian Manatee, in that no measurable discharges of pollutants including sediments are anticipated in implementing the project.

NOAA does not believe that any of its proposed projects constitute major construction activities, and thus does not believe that a biological assessment in addition to this Draft DARP/EA is required to complete its Endangered Species Act consultation requirements. NOAA does not believe that implementation of any of its proposed restoration projects will have adverse effects on any Federal endangered or threatened species. NOAA has submitted this Draft DARP/EA to the Fish and Wildlife Service seeking its concurrence in this no effect determination.

4.4 Marine Mammal Protection Act

The Marine Mammal Protection Act, 16 U.S.C. § 1361 *et seq.*, is the principal Federal legislation for the protection of marine mammals. The Act recognizes the important role that marine mammals play in the ecosystem as well as their recreational and aesthetic value. The Act prohibits, with few exceptions, the taking or importing into the United States of marine mammals or their products. The Act defines "take" as "to harass, hunt, capture, or kill or attempt to harass, hunt, capture, or kill any marine mammal." The U.S. Fish and Wildlife Service and NOAA share responsibility for the management and conservation of these species. In order to comply with this Act, the Trustees will ensure that implementation of the mangrove habitat creation project will not result in a take of West Indian manatees, by avoiding any measurable discharge of pollutants or sediments into adjacent waters that may be occupied or used by manatees.

4.5 Federal Water Pollution Control Act (Clean Water Act)

The FWPCA, 33 U.S.C. § 1251 *et seq*., was established to restore and maintain the chemical, physical and biological integrity of the Nation's waters. The Act sets a long-term goal of eliminating the discharge of pollutants into navigable waters, and an interim goal of attaining water quality that provides for the protection and propagation of fish, shellfish, and wildlife, as well as opportunities for water recreation. The FWPCA and its amendments comprise a complex set of programs and regulations for accomplishing the purposes of the Act, including, among other things, permit programs for discharges from facilities and other "point sources," specific discharge limitations for certain identified pollutants or categories of pollutants, provision for qualitative and quantitative water quality standards to be set by the States for their water bodies, and regulation of dredge and fill operations.

The Act's definitions of "pollutant," "discharge," and "fill" are so broad as to make the Act applicable to the mangrove habitat creation project. In general terms, the Trustees or their contractor will be required to apply for a permit to discharge pollutants into the marine environment in order to implement this project. The permit will need to include a certification that the discharges involved will not violate any of the State's applicable water quality standards. Further, to comply with the Act's guidelines for dredge and fill projects, the Trustees will have to demonstrate that there is no practicable alternative to the project that will have less adverse

impact on the aquatic ecosystem, that the discharges will not contribute to the significant degradation of the marine environment, and that the project will be performed to minimize potential adverse impacts.

Given their previous experience with implementing mangrove habitat creation projects, the Trustees are confidant that the preferred restoration alternatives can be implemented in compliance with the FWPCA.

4.6 Ocean Dumping - Marine Protection, Research and Sanctuaries Act

Like section 404 of the Clean Water Act, applicable sections of the MPRSA prohibiting "unregulated dumping of material" into the ocean have been interpreted and applied broadly so as to be applicable to the Trustees' proposed mangrove habitat creation project. Compliance with the provisions of this Act requires a permit from the Environmental Protection Agency, which may be issued when it is determined that the "dumping" will not unreasonably degrade or endanger human health or welfare, the marine environment, or economic potentialities. Criteria considered in issuing a permit include the need for the dumping, the effects on human health and welfare, including economic, esthetic and recreational values, effects on fisheries resources, shorelines and beaches, and the persistence and permanence of effects of the dumping.

4.7 Rivers and Harbors Act

Provisions of the Rivers and Harbors Act (33 U.S.C. § 401 *et seq.*) that are applicable to the Trustees' proposed restoration projects prohibit the creation of any obstruction not affirmatively authorized by Congress, to the navigable capacity of any of the waters of the United States. During permit application consultations with the Army Corps of Engineers required for compliance with the Clean Water Act, the Trustees will request a determination whether the proposed mangrove habitat creation project is subject to the requirements of the Rivers and Harbors Act, and if so, what conditions need to be incorporated into a permit in order to implement the projects in compliance with the Act.

4.8 Archaeological Resources Protection Act

The Archaeological Resources Protection Act, 16 U.S.C. § 470aa *et seq.*, was established for the purpose of protecting, for present and future generations of the American people, archaeological resources and sites on public lands, which include lands owned by the Federal government or Indian tribes. The Act prohibits any person, without a permit, from excavating, removing, damaging, altering, or defacing archaeological resources on or from public lands. The Act is administered by the Department of the Interior (DOI).

During the response phase of the mystery incident, the Administrator for the Historic Commission of Broward County and the Consulting Archaeologist for Broward County informed the U.S. Coast Guard that the entire length of the Broward County shoreline above the high tide line should be considered as likely to contain undiscovered archaeological sites or artifacts. Thus, sea oat and shade tree planting, and dune walkover installation will require consultation with State and Federal historic preservation officers prior to, and perhaps during,

project implementation to ensure that any archaeological resources are properly protected and preserved.

4.9 Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) - Essential Fish Habitat Assessment for Mangrove Habitat Creation Project

The Magnuson-Stevens Act (16 U.S.C. § 1801 *et seq.*) as amended and reauthorized by the Sustainable Fisheries Act (Public Law 104-297) established a program to promote the protection of essential fish habitat (EFH) through the review of projects conducted under Federal permits, licenses, or other authorities that affect or have the potential to affect such habitat. After EFH has been described and identified in fishery management plans by the respective regional fishery management councils, Federal agencies are obligated to consult with the Secretary of Commerce, acting through the National Marine Fisheries Service, with respect to any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken, by such agency that *may* adversely affect any EFH.

The South Atlantic Fishery Management Council ("SAFMC") is responsible for issuing fishery management plans and identifying EFH for areas including southeast Florida. Mangrove habitat is the only identified EFH that is relevant to the proposed restoration projects; all other projects will be implemented well onshore. The SAFMC has identified the following managed species that utilize mangrove habitat during one or more of their lifestages: subadult red drum, juvenile goliath grouper, post larval and juvenile gray snapper, juvenile mutton snapper, and adult white grunt.

NOAA believes that there will be no adverse effects on mangrove EFH resulting from implementation of the mangrove restoration project. This project will comprise removing soil from an area currently vegetated mostly with invasive tree species, so as to create intertidal elevations to allow the flooding of the habitat. In addition to removing the exotic species, limited planting of mangrove propagules may be implemented, if, in the Trustees' judgment, such planting would measurably enhance recruitment from surrounding established mangroves. Thus, this project will result in only beneficial impacts, by creating additional essential fishery habitat. The National Marine Fisheries Service will be asked whether it concurs with this finding; correspondence will be included in the Administrative Record.

4.10 Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act, 16 USC § 661 *et seq.*, requires that Federal agencies consult with the U.S. Fish and Wildlife Service, the National Marine Fisheries Service, and State wildlife agencies for activities that result in the impoundment, diversion, channel deepening, or control or modification of any stream or water body, to minimize and mitigate any adverse effects on fish and wildlife resources and habitats. Impoundments of less than 10 acres of surface water are exempted from the consultation requirements. The mangrove habitat creation project is the only restoration project that involves physical construction activity near surface waters, and this project will consist mainly of scraping down an upland area to create intertidal habitat elevations. Thus, it is unlikely that this project will involve impounding, diverting or

other control or modification of surface waters. Even if any temporary impounding of surface waters is required in order to implement this project, it would likely involve far less than 10 acres of surface waters.

4.11 Fish and Wildlife Conservation Act

The Fish and Wildlife Conservation Act, 16 USC § 2901 et seq., encourages all Federal departments and agencies to use their statutory and administrative authorities to the maximum extent practicable and consistent with the agency's statutory responsibilities, to conserve and to promote the conservation of nongame fish and wildlife species and their habitats. The Trustees' restoration projects, particularly the turtle hatchling protection projects and the mangrove habitat creation project, forward the purposes of this Act.

4.12 Executive Order 11990, Protection of Wetlands

Executive order 11990, signed on May 25, 1977, requires all Federal agencies to avoid, to the extent possible, long and short-term adverse impacts associated with the destruction or modification of wetlands through development or construction projects that they fund, approve or implement. The Trustees' mangrove habitat creation project will establish new wetland habitat, and will be implemented so as not to cause any collateral injury to or loss of other wetlands.

4.13 Executive Order 12962, Recreational Fisheries

This executive order, signed on June 7, 1995, requires Federal agencies, to the extent permitted by law and in cooperation with States and tribes, to improve the quantity, function, sustainable productivity, and distribution of U.S. aquatic resources for increased recreational fishing opportunities. The order allows Federal agencies to fulfill this mandate through a variety of means, including the following which are applicable to the proposed restoration projects:

(a) identifying recreational fishing opportunities that are limited by water quality and habitat degradation and promoting restoration to support viable, healthy, and, where feasible, self-sustaining recreational fisheries;
(b) fostering sound aquatic conservation and restoration endeavors to benefit recreational fisheries; and
(c) implementing laws under their purview in a manner that will conserve, restore, and enhance aquatic systems that support recreational fisheries.

The Trustees' proposed mangrove habitat creation project was selected to compensate for the loss of fishery resources and production caused by the mystery incident. Mangrove habitats have been documented as assisting in the production of fish biomass, by providing food, shelter, and nursery functions to fish and invertebrates.

4.14 Executive Order 12898, Environmental Justice

On February 11, 1998, President Clinton signed Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations. This order requires each Federal agency to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations. EPA and the Council on Environmental Quality have emphasized the importance of incorporating environmental justice reviews in the analysis conducted by Federal agencies under NEPA, and of developing mitigation measures that avoid disproportionate environmental effects on minority and low-income populations. The Trustees have concluded that there are no low-income or minority communities that would be adversely affected by the proposed restoration projects.

4.15 Executive Order 13112, Invasive Species

This executive order, signed on February 3, 1999, directs all Federal agencies to take certain steps if their activities may affect the status of invasive species. The Trustees' mangrove habitat creation project will involve removal of invasive species, and thus "provide for restoration of native species and habitat conditions in ecosystems that have been invaded," as mandated by this executive order.

References

Barker, V., 2002. Letter from Virginia Barker, Brevard County Natural Resources Management Office, to Tom Moore, NOAA, re: proposal for protecting marine turtle hatchlings in Brevard County. March 1, 2002. (AR document # 4.3.3)

Bell, F. W. and V. R. Leeworthy (1986). An Economic Analysis of the Importance of Saltwater Beaches in Florida. Florida State University, Department of Economics, Tallahassee, FL, Florida Sea Grant College, Report Number 82, Sea Grant Project No. R/C-P-12. (AR # 3.6.1)

Broward County Economic Profile, 1996 data.
Website location: http://www.broward.org/cni02000.htm

Davis, P., 2002a. Letter from Paul Davis, Palm Beach County, to Tom Moore, NOAA, re: "Proposal to Increase Sea Turtle Hatchling Productivity in Palm Beach County," February, 2002. (AR # 4.3.2)

Davis, P., 2002b. Personal communication with Mark Sramek, NOAA. March 20, 2002.

Environmental Economics Research Group, 1998. Natural Resource Damage Assessment for the Tampa Bay Oil Spill: Recreational Use Losses for Florida Residents. (AR # 4.7.2)

Ford, R., Himes-Boor, G., and J. Ward, 2001. Sea Bird Mortality Resulting From the M/V "New Carissa" Oil Spill Incident, February and March 1999. Report to the U.S. Fish and Wildlife Service, May 14, 2001. (AR # 3.4.8)

Fox, L., 2002. Personal communication with Tony Penn, NOAA. January, 2002.

French-McCay, D., Galagan, C., and Nicole Whittier, 2001. Final Report: Florida Mystery Spill of August 2000: Modeling of Physical Fates and Biological Injuries. Report to the NOAA Damage Assessment Center by Applied Science Associates, October, 2001. (AR # 3.4.4)

Jeansonne, J., 2000. Telephone call log with Judy LaRose, Wildlife Care Center, Fort. Lauderdale, FL, re: wildlife rehabilitation related to this incident. August 14, 2000. (AR # 2.2.1)

Jeansonne, J., 2001a. Summary of Sea Turtle Population Distribution Estimates for Affected Atlantic Ocean Waters. Memorandum from Jim Jeansonne to Fort Lauderdale Mystery Spill Administrative Record File. June 19, 2001. (AR # 3.3.5)

Jeansonne, J., 2001b. Final Summary of Trustee Sea Turtle Injury Technical Team Call. September 21, 2001. (AR # 3.3.9)

Jeansonne, J., 2002a. Biological Injury Assessment: Analysis of OPA Regulatory Requirements for Injury Determination and Quantification. Memorandum from Jim Jeansonne to Fort Lauderdale Mystery Spill Administrative Record File. June 10, 2002. (AR # 3.5.1)

Jeansonne, J., 2002b. Sea Turtle Primary Restoration Scaling: Quantifying the number of hatchlings required to replace the injured juvenile and adult sea turtles. Memorandum from Jim Jeansonne to Fort Lauderdale Florida Mystery Spill Case File. April 26, 2002. (AR # 4.7.8)

Kaoru, Y. (1993). "Discrete-Choice Contingent Valuation of Beach Recreation Benefits for Tourists and Local Residents." Marine Policy Center, Woods Hole Oceanographic Institution Contribution No. 8500, September 23, 1993. (AR # 3.6.2)

Michel, J., 2001. Mangrove Habitat Injury Assessment and Scaling Protocols Final Report. Report submitted to NOAA Damage Assessment Center. (AR # 4.7.14).

Morey, E. R., R. D. Rowe and D. Waldman (1995). Revised Report and Rebuttal: Assessment of Damages to Anglers and Other Recreators From Injuries to the Upper Clark Fork River Basin. Report to the State of Montana, Natural Resource Damage Program by RCG/Hagler Bailly, October, 1995. (AR # 3.6.3)

NOAA, 1999. Discounting and the Treatment of Uncertainty in Natural Resource Damage Assessment, Technical Paper 99-1. National Oceanic and Atmospheric Administration, Damage Assessment and Restoration Program.
Website location: http://www.darp.noaa.gov/publicat.htm

Penn, T., 2002a. Lost Recreational Beach Use Injury: Analysis of Regulatory Requirements for Injury Determination, Injury Selection and Quantification. Memorandum from Tony Penn to Fort Lauderdale Mystery Spill Administrative Record File. April 22, 2002. (AR # 3.7.1)

Penn, T., 2002b. Service-to-Service Compensatory Restoration Scaling. Memorandum from Tony Penn to Fort Lauderdale Mystery Spill Administrative Record File. June 14, 2002. (AR # 4.7.9)

Robertson, W. B., Jr. and J. M. Kushlan, 1984. The Southern Florida Avifauna. In P. J. Gleason, ed., Environments of South Florida: Present and Past II, pp. 219 - 257. Miami Geological Survey; Coral Gables, FL. (AR # 4.1.5)

Sramek, M., 2002. Cost of Beachfront Property Acquisition for Sea Turtle Restoration Memorandum from Mark Sramek to Fort Lauderdale Mystery Spill Administrative Record File. June 5, 2002. (AR # 4.7.10)

U.S. Fish and Wildlife Service, Southeast Region, 1999. South Florida Multi-Species Recovery Plan, The Ecological Communities pages 3-623 – 3-642. (AR # 4.1.4)

United States Geological Survey, 1996. Circular 1134, The South Florida Environment: A Region under Stress.
Website location: http://sofia.usgs.gov/publications/circular/1134/esas/urban.html

Walsh, R. G., Johnson, D. M., and J. R. McKean, 1992. Benefit Transfer of Outdoor Recreation Demand Studies, 1968 – 198*8*. Water Resources Research, 28(3), pages 707 – 713.

Witherington, B., 2001. "Sea Turtle Density Estimates in Vicinity of 8/8/00 Mystery Spill", letter from Dr. Blair Witherington, Florida Marine Research Institute, to J. Jeansonne, NOAA. May 29, 2001. (AR # 3.3.3)

Yanez-Arancibia, A., Linares, F.A., and J.W. Day Jr., 1980. Fish Community Structure and Function in Terminos Lagoon, A Tropical Estuary in the Southern Gulf of Mexico. Estuarine Perspectives pages 465 – 482.

Appendix A: South Florida Threatened and Endangered Species

Species	Federal Status	Habitat
Florida panther Puma (=Felis) concolor coryi	E	High pine, Tropical hardwood hammock, Scrub, Maritime hammock, Mesic temperate hammock, Pine rockland, Scrubby flatwoods, Mesic pine flatwoods, Hydric pine flatwoods, Dry prairie, Wet prairie, Freshwater marsh, Seepage swamp, Pond swamp, Mangrove
Key deer *Odocoileus virginianus clavium*	E	Tropical hardwood hammock, Mesic temperate hammock, Pine rockland, Mesic pine flatwoods, Hydric pine flatwoods, Freshwater marsh, Mangrove, Saltmarsh
Key Largo cotton mouse *Peromyscus gossypinus allapaticola*	E	Tropical hardwood hammock
Key Largo woodrat *Neotoma floridana smalli*	E	Tropical hardwood hammock
Lower Keys rabbit *Sylvilagus palustris hefneri*	E	Beach dune/Coastal strand, Freshwater marsh, Mangrove, Saltmarsh
Puma (=Mountain lion) *Puma (=Felis) concolor*	T (S/A)	High pine, Tropical hardwood hammock, Scrub, Maritime hammock, Mesic temperate hammock, Pine rockland, Scrubby flatwoods, Mesic pine flatwoods, Hydric pine flatwoods, Dry prairie, Wet prairie, Freshwater marsh, Seepage swamp, Flowing water swamp, Pond swamp, Mangrove
Rice rat (=silver rice rat) *Oryzomys palustris natator (=O. argentatus)*	E (CH)	Freshwater marsh, Mangrove, Saltmarsh
Southeastern beach mouse *Peromyscus polionotus niveiventris*	T	Beach dune/Coastal strand
West Indian manatee *Trichechus manatus*	E (CH)	Mangrove, Seagrass, Nearshore reef
Audubon's crested caracara Polyborus plancus audubonii	T	Mesic temperate hammock, Mesic pine flatwoods, Hydric pine flatwoods, Dry prairie, Wet prairie
Bachman's warbler *Vermivora bachmanii*	E	Mesic temperate hammock, Flowing water swamp
Bald eagle *Haliaeetus leucocephalus*	T	High pine, Scrubby high pine, Maritime hammock, Mesic temperate hammock, Pine rockland, Scrubby flatwoods, Mesic pine flatwoods, Hydric pine flatwoods, Dry prairie, Wet prairie, Freshwater marsh, Seepage swamp, Flowing water swamp, Pond swamp, Mangrove, Saltmarsh
Cape Sable seaside sparrow *Ammodramus(=Ammospiza) maritimus mirabilis*	E (CH)	Wet prairie, Freshwater marsh
Everglade snail kite *Rostrhamus sociabilis plumbeus*	E (CH)	Hydric pine flatwoods, Freshwater marsh, Pond swamp

Florida grasshopper sparrow *Ammodramus savannarum floridanus*	E	Dry prairie, Wet prairie
Florida scrub-jay *Aphelocoma coerulescens*	T	Scrub, Scrubby flatwoods
Ivory-billed woodpecker *Campephilus principalis*	E	Mesic temperate hammock, Seepage swamp, Flowing water swamp, Pond swamp
Kirtland's warbler *Dendroica kirtlandii*	E	Tropical hardwood hammock, Scrub, Scrubby high pine, Beach dune/Coastal strand, Maritime hammock, Mesic temperate hammock, Pine rockland, Scrubby flatwoods, Mesic pine flatwoods, Hydric pine flatwoods, Seepage swamp, Flowing water swamp, Pond swamp
Piping plover *Charadrius melodus*	T	Beach dune/Coastal strand, Nearshore reef
Red-cockaded woodpecker *Picoides (= Dendrocopos) borealis*	E	High pine, Mesic pine flatwoods, Hydric pine flatwoods
Roseate tern *Sterna dougallii dougallii*	T	Beach dune/Coastal strand, Saltmarsh, Seagrass, Nearshore reef
Whooping crane *Grus americana*	XN	Dry prairie, Wet prairie, Freshwater marsh
Wood stork *Mycteria americana*	E	Hydric pine flatwoods, Wet prairie, Freshwater marsh, Seepage swamp, Flowing water swamp, Pond swamp, Mangrove, Saltmarsh, Seagrass
American alligator *Alligator mississippiensis*	T (S/A)	Hydric pine flatwoods, Wet Prairie, Freshwater marsh, Seepage swamp, Pond Swamp, Mangrove, Hydric pine flatwoods, Wet prairie, Seepage swamp, Flowing water swamp, Pond swamp
American crocodile *Crocodylus acutus*	E (CH)	Mangrove, Seagrass
Atlantic salt marsh snake *Nerodia clarkii (=fasciata) taeniata*	T	Saltmarsh
Bluetail (=blue-tailed) mole skink *Eumeces egregius lividus*	T	High pine, Scrub
Eastern indigo snake *Drymarchon corais couperi*	T	High pine, Tropical hardwood hammock, Scrubby high pine, Beach dune/Coastal strand, Maritime hammock, Mesic temperate hammock, Pine rockland, Scrubby flatwoods, Mesic pine flatwoods, Hydric pine flatwoods, Dry prairie, Cutthroat grass, Freshwater marsh, Seepage swamp, Flowing water swamp, Pond swamp, Mangrove
Green sea turtle *Chelonia mydas (incl. Agassizi)*	E	Beach dune/Coastal strand, Seagrass, Nearshore reef
Hawksbill (=carey) sea turtle *Eretmochelys imbricata*	E	Beach dune/Coastal strand, Seagrass, Nearshore reef

Kemp's (=Atlantic) ridley sea turtle *Lepidochelys kempii*	E	Beach dune/Coastal strand, Seagrass, Nearshore reef
Leatherback sea turtle *Dermochelys coriacea*	E	Beach dune/Coastal strand, Seagrass, Nearshore reef
Loggerhead sea turtle *Caretta caretta*	T	Beach dune/Coastal strand, Seagrass, Nearshore reef
Sand skink *Neoseps reynoldsi*	T	High pine, Scrub
Highlands tiger beetle *Cicindela highlandensis*	C	Scrub
Schaus swallowtail butterfly Heraclides (= Papilio) aristodemus ponceanus	E	Tropical hardwood hammock
Stock Island tree snail *Orthalicus reses* (not incl. *nesodryas*)	T	Tropical hardwood hammock
Avon Park harebells *Crotalaria avonensis*	E	Scrub
Beach jacquemontia *Jacquemontia reclinata*	E	Beach dune/Coastal strand
Beautiful pawpaw *Deeringothamnus pulchellus*	E	Mesic pine flatwoods, Hydric pine flatwoods
Big Pine partridge pea *Chamaecrista lineata var. keyensis*	C	Pine rockland
Blodgett's silverbush *Arygythamnia blodgettii*	C	Tropical hardwood hammock, Pine rockland
Britton's beargrass *Nolina brittoniana*	E	High pine, Scrub, Scrubby high pine, Scrubby flatwoods
Cape Sable thoroughwort *Chromolaena frustrata*	C	Tropical hardwood hammock, Pine rockland
Carter's mustard *Warea carteri*	E	High pine, Scrub, Scrubby high pine, Scrubby flatwoods, Mesic pine
Crenulate lead-plant *Amorpha crenulata*	E	Pine rockland
Deltoid spurge *Chamaesyce(=Euphorbia) deltoidea ssp. deltoidea*	E	Beach dune/Coastal strand, Pine rockland
Florida bonamia *Bonamia grandiflora*	T	High pine, Scrub, Scrubby high pine

Florida brickell-bush *Brickellia mosieri*	C	Pine rockland
Florida golden aster *Chrysopsis (=Heterotheca) floridana*	E	Scrub
Florida perforate cladonia *Cladonia perforata*	E	Scrub
Florida pineland crabgrass *Digitaria pauciflora*	C	Pine rockland, Freshwater marsh, Seepage swamp
Florida ziziphus *Ziziphus celata*	E	High pine, Scrub
Florida's semaphore cactus *Opuntia corallicola*	C	Tropical hardwood hammock, Beach dune/Coastal strand
Four-petal pawpaw *Asimina tetramera*	E	Scrub
Fragrant prickly-apple *Cereus eriophorus var. fragrans*	E	Scrub, Scrubby flatwoods
Garber's spurge *Chamaesyce(=Euphorbia) garberi*	T	Pine rockland
Garrett's mint *Dicerandra christmanii*	E	High pine, Scrub, Scrubby high pine
Highlands scrub hypericum *Hypericum cumulicola*	E	Scrub
Johnson's seagrass Halophila johnsonii	T	Seagrass
Key tree-cactus *Pilosocereus (=Cereus) robinii*	E	Tropical hardwood hammock
Lakela's mint *Dicerandra immaculata*	E	Scrub
Lewton's polygala *Polygala lewtonii*	E	High pine, Scrub, Scrubby high pine
Okeechobee gourd *Cucurbita okeechobeensis ssp. Okeechobeensis*	E	Freshwater marsh, Pond swamp
Papery whitlow-wort *Paronychia chartacea(=Nyachia pulvinata)*	T	High pine, Scrub
Pigeon wings *Clitoria fragrans*	T	High pine, Scrub, Scrubby high pine, Scrubby flatwoods

Pineland sandmat *Chamaesyce ssp. pinetorum*	C	Pine rockland
Pygmy fringe-tree *Chionanthus pygmaeus*	E	Scrub, Scrubby high pine
Sand Flax *Linum arenicola*	C	Pine rockland
Sandlace *Polygonella myriophylla*	E	Scrub, Scrubby high pine
Scrub blazing star *Liatris ohlingerae*	E	High pine, Scrub, Scrubby flatwoods
Scrub buckwheat *Eriogonum longifolium var. gnaphalifolium*	T	High pine, Scrub, Scrubby high pine
Scrub lupine *Lupinus aridorum*	E	Scrub
Scrub mint *Dicerandra frutescens*	E	High pine, Scrub, Scrubby high pine
Scrub plum *Prunus geniculata*	E	High pine, Scrub, Scrubby high pine
Short-leaved rosemary *Conradina brevifolia*	E	High pine, Scrub
Small's milkpea *Galactia smallii*	E	Pine rockland
Snakeroot *Eryngium cuneifolium*	E	Scrub
Tiny polygala *Polygala smallii*	E	High pine, Scrub, Pine rockland, Scrubby flatwoods
Wedge spurge *Chamaesyce deltoidea ssp. serpyllum*	C	Pine rockland
Wide-leaf warea *Warea amplexifolia*	E	High pine
Wireweed *Polygonella basiramia(=ciliata var. b.)*	E	Scrub

E = Endangered
T = Threatened
T (S/A) = Similarity of Appearance to a Threatened Taxon
E (CH) = Endangered, Critical Habitat Designated
XN = Experimental Population, Non-Essential
C = Candidate Taxon, Ready for Proposal

Appendix B: Beach Attendance Data

The following tables contain attendance data provided by Captain Tom Fogen, Sidney Leve, Captain Glenn Morris, and Jim Shoemaker for Fort Lauderdale Beach, John U. Lloyd Beach State Recreation Area, Dania Beach, and Hollywood Beach, respectively. Attendance at the three miles of Fort Lauderdale Beach is estimated by lifeguards. The guards count groups of fifty at 11:00 a.m. and between 2:00 and 2:30 p.m. The two counts are added to estimate a daily total; the afternoon total is adjusted to avoid double-counting the morning users who remain at the beach through the afternoon count. The attendance data at John U. Lloyd State Park is based on the count of individuals in vehicles as they enter the Park. There is some boating and fishing by the users, but, for the most part, they are beach-goers. The attendance figures for Dania Beach are based on lifeguard counts. Head counts are conducted twice a day in early and late afternoon. Those who are counted in the early afternoon are not to be counted again later in the afternoon. Beachgoers at Hollywood Beach are counted by the lifeguards in the 21 first aid stations that cover the 4.5 miles of beach. There are rolling head counts at 11:00 a.m., 1:00 p.m., 3:00 p.m., and 5:00 p.m.; at each count after 11:00, only newcomers to the beach are added to the total.

Fort Lauderdale

Weekly Tabulation of Beach Users

Week of	Monday	Tuesday	Wednesday	Thursday	Friday	*Weekday Total*	Saturday	Sunday	*Weekend Total*
7/24/00	5,200	3,275	4,450	4,450	6,100	*23,475*	8,400	10,900	*19,300*
7/31/00	8,050	5,175	4,050	5,600	8,100	*30,975*	11,950	4,550	*16,500*
8/7/00	5,950	4,570*	2,375*	4,150	5,500	*22,545*	5,300	9,050	*14,350*
8/14/00	5,850	5,350	4,700	7,300	4,650	*27,850*	7,200	9,800	*17,000*
8/21/00#	4,700	4,725	5,700	5,325	4,075	*24,525*	5,850	4,350	*10,200*

John U. Lloyd Beach State Recreation Area

Weekly Tabulation of Park Visitors

Week of	Monday	Tuesday	Wednesday	Thursday	Friday	*Weekday Total*	Saturday	Sunday	*Weekend Total*
7/24/00	857	684	1,028	879	1,237	*4,685*	2,406	4,010	*6,416*
7/31/00	1,046	844	802	725	1,132	*4,549*	2,691	4,158	*6,849*
8/7/00	1,012	548*	230*	447	658	*2,895*	1,798	2,915	*4,713*
8/14/00	1,066	745	802	733	686	*4,032*	2,439	4,207	*6,646*
8/21/00#	896	927	844	704	792	*4,163*	1,523	1,999	*3,522*

Dania Beach

Weekly Tabulation of Beach Users

Week of	Monday	Tuesday	Wednesday	Thursday	Friday	*Weekday Total*	Saturday	Sunday	*Weekend Total*
7/24/00	250	200	200	150	250	*1,050*	600	700	*1,300*
7/31/00	400	225	500	225	225	*1,575*	700	1,200	*1,900*
8/7/00	200	200*	10*	50	150	*610*	250	800	*1,050*
8/14/00	500	200	250	175	200	*1,325*	500	1,200	*1,700*
8/21/00#	200	300	250	250	250	*1,250*	475	300	*775*

Hollywood Beach

Weekly Tabulation of Beach Users

Week of	Monday	Tuesday	Wednesday	Thursday	Friday	*Weekday Total*	Saturday	Sunday	*Weekend Total*
7/24/00	11,767	7,138	10,985	9,181	9,735	*48,806*	20,083	23,077	*43,160*
7/31/00	11,048	10,360	6,034	11,038	11,140	*49,620*	19,590	3,903	*23,493*
8/7/00	10,898	4,519*	4,445*	7,439	7,860	*35,161*	8,892	29,520	*38,412*
8/14/00	8,690	7,091	9,660	11,180	7,970	*44,591*	22,260	31,795	*54,055*
8/21/00#	8,640	9,395	7,405	8,150	10,805	*44,395*	18,900	11,355	*30,255*

* Indicates days when the beaches were closed to swimming.

Hurricane Debby threatened south Florida late this week.

Appendix C: National Climatic Data Center Precipitation Data for Fort Lauderdale, FL (Fort Lauderdale/Hollywood International Airport)

UNEDITED HOURLY PRECIPITATION TABLE

Month: August, 2000

DT	A.M. HOUR (L.S.T) ENDING AT												DT	P.M. HOUR (L.S.T) ENDING AT											DT
	1---	2---	3---	4---	5---	6---	7---	8---	9---	10--	11--	12--		1---	2---	3---	4---	5---	6---	7---	8---	9----	10--	11--	12--	
1	----	----	----	----	----	----	----	----	----	----	----	----	1	----	----	----	----	----	----	.45	.67	----	----	----	----	1
2	----	----	----	----	----	----	----	----	----	----	----	----	2	.24	T	.32	.26	.24	T	T	----	----	----	----	----	2
3	----	----	----	.01	.08	.01	----	.01	----	----	----	----	3	----	----	----	----	----	----	----	.16	----	----	----	----	3
4	----	----	----	T	T	----	.07	----	----	----	----	----	4	----	----	----	----	----	----	----	----	----	----	----	----	4
5	----	----	----	----	----	----	----	----	----	T	T	----	5	----	----	----	----	----	----	----	----	----	----	----	----	5
6	----	----	----	----	----	----	----	----	----	----	.39	.03	6	.01	.05	.02	----	----	----	----	----	----	----	----	----	6
7	----	----	----	----	----	----	----	----	----	----	----	----	7	----	----	----	----	----	----	----	----	----	----	----	----	7
8	----	----	----	----	----	----	----	----	----	----	----	----	8	----	----	----	----	----	----	----	----	----	----	----	----	8
9	----	----	----	----	----	----	----	----	----	----	----	----	9	----	----	----	----	----	----	----	----	----	----	----	----	9
10	----	----	----	----	----	----	----	----	----	----	----	----	10	----	----	----	----	T	T	----	----	----	----	----	----	10
11	----	----	----	----	----	----	----	----	----	----	----	----	11	----	----	----	----	T	----	----	----	----	----	----	----	11
12	----	----	----	----	----	----	----	----	T	----	----	----	12	T	----	----	.51	T	----	.01	T	----	----	----	----	12
13	----	----	----	----	----	----	----	----	----	----	----	T	13	T	----	----	----	----	----	----	----	----	----	----	----	13
14	----	----	----	----	----	----	----	----	----	----	----	----	14	----	----	----	T	.04	.01	.16	T	----	----	----	----	14
15	----	----	----	----	----	----	----	----	----	----	----	----	15	----	----	.05	----	----	----	----	----	----	----	----	----	15
16	----	----	----	----	----	----	----	----	----	----	----	----	16	----	----	----	----	----	----	----	----	----	----	----	----	16
17	----	----	----	----	----	----	----	----	----	----	T	T	17	----	----	----	----	----	----	----	----	----	----	----	----	17
18	----	----	----	----	----	T	.38	----	----	.48	----	.01	18	----	----	----	----	----	----	----	----	----	----	----	----	18
19	----	----	----	----	----	----	----	----	----	----	.04	T	19	----	----	----	----	.01	----	----	----	----	----	----	----	19
20	----	----	----	----	----	----	----	----	----	----	----	----	20	----	----	----	----	----	----	----	----	----	----	----	----	20
21	----	----	.07	T	----	----	T	----	.05	T	----	----	21	----	----	----	----	----	----	----	----	----	----	----	----	21
22	----	----	----	----	----	----	----	----	----	----	----	----	22	----	----	----	----	----	----	----	----	----	----	----	----	22
23	----	----	T	----	----	----	.06	T	----	----	----	----	23	----	----	----	----	----	----	----	----	----	----	----	----	23
24	----	----	----	----	----	----	----	----	----	T	----	----	24	----	----	----	----	----	----	----	----	----	----	----	----	24
25	----	----	----	----	T	----	----	----	----	----	----	----	25	----	----	----	----	----	----	----	----	----	----	----	.03	25
26	.12	.07	.07	.02	.01	.01	.01	----	----	----	.27	----	26	----	----	----	----	----	----	----	.1	.03	T	----	----	26
27	----	T	----	----	----	----	----	.48	.01	----	----	----	27	----	----	----	----	----	----	----	----	----	----	----	----	27
28	----	----	----	----	----	----	----	----	----	----	----	----	28	----	.01	1.1	.08	----	----	----	----	----	----	----	----	28
29	----	----	----	----	----	----	.01	----	----	----	----	----	29	----	----	6	----	----	----	----	----	----	----	----	----	29
30	----	----	----	----	----	----	----	----	----	----	T	----	30	----	----	----	----	----	----	.01	----	----	----	----	----	30
31	----	----	----	----	----	----	----	----	----	----	.58	1.57	31	.14	T	----	----	----	T	----	----	----	----	----	----	31

Appendix D: Wildlife Injury Quantification (Section 5.2) of the SIMAP Report. (French-McCay, et al., 2001)

Table 5-2 lists the model-estimated wildlife kills for the model simulations assuming the best spill volume estimate. The seabird pre-spill abundance was assumed to be as in the NRDAM/CME database. The majority of the estimated killed birds were cormorants. Assuming the most likely release time of 2000-2100 on 7 August, the seabird injury is estimated at 12 birds. The uncertainty in the release time translates to a range of bird injury of 10-17 birds. In addition, there is uncertainty in the pre-spill abundance. If the pre-spill abundance were, for example, a factor two different, the model kill estimate would change by that same factor. Appendix N provides the wildlife injury results for all the model runs.

The estimated number of turtles impacted by the is also given in Table 5-2. It is estimated that the combined juvenile and adult impact amounted to approximately 1 adult and/or juvenile turtle. This estimate is calculated as the water area swept by the oil times turtle abundance times a probability of 1% that juvenile or adult turtles would be on the water surface as the oil passes by, be oiled, and die from that oiling. Thus, the uncertainty of the predicted injury is directly proportional to that of the assumed abundance and oiling/mortality probability. The range of estimates for oiling probability was 1-10%, with 1% assumed yielding the approximately 1 adult and/or juvenile turtle injured. If the probability is more correctly 10%, the injury would be approximately 10 adult and/or juvenile turtles.

The estimated number of hatchlings impacted was calculated as the water area west of the Gulf Steam swept by the oil times the hatchling abundance, times a probability of 50% that hatchlings would be on the water surface as the oil passes by and therefore be oiled and die. The best estimate of injury is about 7,800 turtles. The uncertainty in the injury estimate is directly proportional to the uncertainty in the assumed abundance and the oiling/mortality probability. There is less uncertainty in the hatchling injury estimate resulting from the timing of the oil release than for seabirds and older turtles since the hatchling turtles are all assumed west of the Gulf Steam, while all the oil release times are for locations within the Gulf Stream.

Table 5-2. Estimated number of seabirds and sea turtles oiled for the spill released over one hour beginning at the time (hours) indicated (volume released = 20,456 gal.).

Species Category	**1900**	**2000**	**2200**
Cormorants	12.06	8.31	7.24
Gannets and boobies	0.06	0.04	0.03
Gulls	0.39	0.27	0.23
Phalaropes	1.15	0.79	0.69
Shearwaters	0.05	0.04	0.03
Skimmers	0	0	0
Storm petrels	0.12	0.08	0.07
Terns	1.13	0.78	0.68
Pelicans	1.87	1.29	1.12
Total Seabirds	16.8	11.6	10.1

Sea turtle hatchlings	9,360	7,800	7,800
Sea turtle juveniles	0.71	0.50	0.42
Sea turtle adults	0.17	0.12	0.10

Cetaceans and manatees, while in the area impacted by the spill, were estimated to have a very low probability of oiling in the model simulations. The results were 0.02 dolphin and 0.01 manatee for the best estimate case. As these results are probabilities and no marine mammals were observed affected by the spill, the injury to marine mammals is assumed zero.

Appendix E: Fish & Invertebrates Injury Quantification (Section 5.3) of the SIMAP Report. (French-McCay, et al., 2001)

Tables N-2 to NM-10 in Appendix N list the kills of fish and invertebrates, assuming the abundances in the NRDAM/CME and the LC50 for species of average sensitivity where LC50? for the oil PAH mixture = 45 mg/L. As none of the species of concern have been shown to be highly sensitive or resistent to PAHs (French McCay, 2001), the results for the LC50 = 45 mg/L are the best estimates. Young-of-the-year and older age class impacts are included in the kills of Tables M-2 to M-10. Table M-6 contains the best estimate of injury to fish and invertebrates. The biomass equivalent of the direct kill (from Table M-6) is 4600 kg.

Tables N-2 to N-10 list the calculated production foregone and total injury (= direct kill plus production foregone) in kg. Assuming the release was between 2000 and 2100 hrs and using the best estimate of the spill volume, future growth of the killed animals, had there not been a spill, would total 6330 kg (the production foregone). The best estimate of total injury to fish and invertebrates is 10,930 kg (Table N-6). Table 5-3 shows the sensitivity of the results to the assumed release time and volume.

Using the best estimate of the injury, restoration should provide 10,930 kg of equivalent quality fish and invertebrate biomass to compensate for the lost fish and invertebrate production. Equivalent quality implies same or similar species with equivalent ecological role and value for human uses. The equivalent production should be discounted to present-day values to account for the interim loss between the time of the injury and the time restoration provides equivalent ecological and human services.

Table 5-3. Estimated injury to fish and invertebrates, assuming the indicated release time and volume.

Fishery species	Kill as Numbers (#)	Kill as Biomass (kg)	Production Forgone (kg)	Total Biomass Lost (kg)
1900 HI	309,343	5,449	7,196	12,645
1900 Best	232,598	4,172	5,854	10,027
1900 LO	315,654	5,530	6,988	12,518
2000 HI	401,445	6,942	8,402	15,344
2000 Best	**259,408**	**4,598**	**6,332**	**10,930**
2000 LO	153,946	2,705	3,313	6,018
2200 HI	356,484	6,262	7,847	14,109
2200 Best	297,663	5,199	6,437	11,636
2200 LO	264,095	4,610	5,558	10,168

Appendix F: Administrative Record Index

1. RESPONSE PHASE DOCUMENTS

1.1. U.S. Coast Guard Documents and Communications
- 1.1.1. USCG Marine Safety Brief, 8/8/00
- 1.1.2. USCG Marine Safety Brief, 8/9/00
- 1.1.3. Barton, CSSC, Initial Report, 8/8/00
- 1.1.4. Morris, RAR, 8/8/00
- 1.1.5. Morris, Spill Trajectory, 8/8/00
- 1.1.6. Benggio, SSC, Evening Report, 8/8/00
- 1.1.7. Barton, Broward County Cultural Resources, 8/9/00
- 1.1.8. Benggio, SSC, Health & Safety : Oil Samples, 8/9/00
- 1.1.9. Benggio, SSC, Evening Report, 8/9/00
- 1.1.10. Benggio, SSC, Samples results, LSU, 8/9/00
- 1.1.11. Benggio, SSC, Shoreline Cleanup Assessment, 8/10/00
- 1.1.12. NOAA, Shoreline Segment Map, 8/10/00
- 1.1.13. Shoreline Assessment Team, Shoreline Assessment Report, 8/9/00
- 1.1.14. Shoreline Assessment Team, Shoreline Assessment Report, 8/10/00
- 1.1.15. LSU, Chemistry Support Report, 8/10/00
- 1.1.16. Benggio, Evening Report, 8/10/00
- 1.1.17. Benggio, SCAT Report and zone map, 8/10/00
- 1.1.18. Shoreline Assessment Team, Shoreline Assessment Report, 8/10/00
- 1.1.19. Benggio, Diver Survey Plan, 8/10/00
- 1.1.20. USCG, Marine Safety Brief, 8/11/00
- 1.1.21. Wingrove, Dive Operations Update, 8/11/00
- 1.1.22. Benggio, Evening Report, 8/12/00
- 1.1.23. Benggio, Submerged Oil Report, 8/12/00
- 1.1.24. Benggio, Submerged Oil Report, 8/12/02
- 1.1.25. Benggio, Evening Report, 8/12/00
- 1.1.26. USCG, Marine Safety Brief, 8/14/00
- 1.1.27. USCG, Marine Safety Brief, 8/15/00
- 1.1.28. Wingrove, Sitrep, 8/15/00
- 1.1.29. Morris, Overflight Observations, 8/16/00

1.2. National Pollution Funds Center Notices
- 1.2.1. Notice of OPA Claims Procedures, September 2000, Miami Herald

1.3. Media Coverage
- 1.3.1. Miami Herald, Gooey oil, tar splatter 20-mile strip of coast, 8/9/00
- 1.3.2. Miami Herald, Baby sea turtles facing crucial race for survival, 8/9/00
- 1.3.3. Miami Herald, Pollution incidents worry area image-makers, 8/9/00
- 1.3.4. Miami Herald, Humans also can suffer harm from exposure to contamination, 8/9/00

1.3.5. Miami Herald, After seven years, Tampa spill continues to cause problems, 8/9/00
1.3.6. CNN, South Florida beaches closed by oil slick, 8/9/00
1.3.7. Sun-Sentinel, South Florida, Officials hunt source of spill, 8/10/00
1.3.8. Herald.com, Ranger protects turtles from water, 8/10/00
1.3.9. Miami Herald, Most beaches expected to be cleaned up by Friday, 8/10/00
1.3.10. Sun-Sentinel, South Florida, Experts to track spill using chemical fingerprints, 8/10/00
1.3.11. Sun-Sentinel, South Florida, Track source of oily mess, 8/10/00
1.3.12. Miami Herald, Tar studied in spill probe, 8/10/00
1.3.13. AP U.S. News, Ship that dumped off Fla. sought, 8/10/00
1.3.14. Tampa Tribune, South Florida spill worst in decade, 8/11/00
1.3.15. Sun-Sentinel, South Florida, Hollywood, Dania Beach oil cleanups to continue, 8/11/00
1.3.16. Sun-Sentinel, South Florida, Oil jeopardizes baby turtles, 8/11/00
1.3.17. Miami Herald, Chemists await samples to find guilty ships, and Buried tar found off beach, 8/12/00
1.3.18. Ft. Lauderdale, Sun-Sentinel, Coast Guard concedes defeat, says it can't find ship that dumped oil off Broward, 8/30/00

2. PREASSESSMENT PHASE

2.1. Trustee Initiation Request
2.1.1. Interagency Agreement to Initiate NRDA, 8/11/00
2.1.2. Trustee activity report to NPFC, 8/24/00
2.1.3. Correspondence with NPFC re: supplemental request, 11/16/00
2.1.4. Correspondence with NPFC re: intent to recover initiation costs as assessment costs, 5/10/01

2.2. Trustee Preassessment Coordination, Consultation, Sampling & Analysis
2.2.1. Jeansonne telephone call log with Judy LaRose re: wildlife rehabilitation, 8/14/00
2.2.2. NOAA communications re: shore oiling survey observations, 8/14/00
2.2.3. NOAA-U. South Florida correspondence re: sargassum sample oil analysis, 8/15/00
2.2.4. NOAA-USF Inst. Env. Studies correspondence re: tar ball and sargassum sample analyses, 8/21/00
2.2.5. State of FL communications re: turtle nesting and hatching the night of the spill, 8/28/00
2.2.6. Possible Restoration Alternatives, by T. Moore (NOAA), co-trustee draft, 9/5/00
2.2.7. NOAA-contractor communications re: oil release volume estimate and shoreline sampling protocols, 9/29/00
2.2.8. Draft Oil Volume Estimate for SE Florida Mystery Spill, Ft. Lauderdale, FL, Scott Zengel, RPI, 11/8/00
2.2.9. Preassessment Evaluation of Injury to Marine Mammals, in NOAA Damage Assessment Emergency Guidance Manual. Vers. 2.0, October 1995, pp. 101-102
2.2.10. Sargassum tracks and explanation, 8/25/00

2.2.11. Co-trustee 12/8/00 conference call summary, 12/22/00

2.3. Preassessment Regulatory Memoranda
- 2.3.1. Trustee Preassessment Activities and Applicable Regulatory Requirements, Jim Jeansonne memorandum to the file, 5/6/02
- 2.3.2. Section 990.41Verification of OPA Jurisdiction for the Incident, Mo Malvern and Cheryl Scannell memorandum to the file, 5/7/01
- 2.3.3. Section 990.42 Determination to Conduct Restoration Planning, P. Wieczynski and Jim Jeansonne memorandum to the file, 5/7/01

3. RESTORATION PLANNING: INJURY ASSESSMENT

3.1. Trustee Coordination and Deliberation, General
- 3.1.1. Trustee NRDA Assessment Strategy and Action Plan, approved by Trustees 3/15/01
- 3.1.2. Adoption of Case Management & Decision Making Procedures, Cotrustee Resolution 001, 10/17/01

3.2. Notice of Intent to Conduct Restoration Planning
- 3.2.1. Federal Register notice, 66 F.R. 39492, 7/31/01
- 3.2.2. Miami Herald legal notice, 7/31/01
- 3.2.3. Sun-Sentinel legal notice, 7/31/01
- 3.2.4. Incident News webpage notice

3.3. Sea Turtle Injury Assessment
- 3.3.1. Jeansonne communication with Dr. Stephen Baig, NOAA and contractor (ASA) re: Gulf Stream location analysis for injury assessment model, 5/17/01
- 3.3.2. Gulf stream location graphic, by Dr. Stephen Baig, NOAA, from satellite image 5/16/01
- 3.3.3. Witherington letter to Jeansonne re: sea turtle density estimates in vicinity of 8/8/00 mystery spill, 5/29/01
- 3.3.4. Jeansonne communication with cotrustees re: sea turtle input parameters for assessment model, 6/19/01
- 3.3.5. Summary of Sea Turtle Population Distribution Estimates for affected Atlantic Ocean Waters, Draft Jeansonne memorandum to the file, 6/19/01
- 3.3.6. Jeansonne communication with cotrustees re: sea turtle input parameter for assessment model, 7/3/01
- 3.3.7. Jeansonne communication with contractor and cotrustees re: sea turtle surface rates for assessment model, 8/8/01
- 3.3.8. Summary of Trustee Conference Call - August 8, 2001
- 3.3.9. Final Summary of Trustee Sea Turtle Injury Technical Team Call, September 21, 2001
- 3.3.10. Study of the Effects of Oil on Marine Turtles, Final Report to the Minerals Management Service by Vargo, S., P. Lutz, D. Odell, E. Van Vleet, and G. Bossart, FL Inst. of Oceanography, 9/15/86, OCS Study MMS 86-0070.

3.3.11. Residues of Petroleum Hydrocarbons in Tissues of Sea Turtles Exposed to the Ixtoc I Oil Spill, R.J. Hall et al., J. of Wildlife Diseases 19(2): 106-109 (1983)
3.3.12. Ecology of Neonate Loggerhead Turtles Inhabiting Pelagic Fronts Near the Florida Current, B.E. Witherington, 1998
3.3.13. Stock Assessment of Loggerhead Sea Turtles of the Western North Atlantic, S.P. Epperly et al., 2001
3.3.14. Predation on Loggerhead Turtle Hatchlings After Entering the Sea, B.E. Witherington and Michael Salmon, Journal of Herpetology 26 (2): 326-328 (1992)
3.3.15. Survival from Egg to Adulthood in a Declining Population of Loggerhead Turtles, *Caretta Caretta*, Nat B. Frazer, Herpetologica 42(1): 47-55 (1986)

3.4. Ecological Injury Determination & Quantification
3.4.1. Proposal: Modeling Assessment of the South Florida Mystery Spill of August 2000, Applied Science Associates, 2/26/01
3.4.2. SIMAP Overview (undated, from webpage)
3.4.3. Modeling Oil, Chemical Spill Impacts: Linked Submodels - Physical Fates, Biological Effects, Restoration, Compensation Values: Reliably Output Required Data Used in legal Settlements, D.F. McCay, Sea Technology, April 2001
3.4.4. Final Report: Florida Mystery Spill of 2000: Modeling of Physical Fates and Biological Injuries, D.F. McCay et al., October 2001
3.4.5. SIMAP Viewer Users Manual and SIMAPVIEWER compact discs for Florida Mystery Spill of August 2000
3.4.6. Jeansonne memo with contractor re: spill scenario information estimated by the trustee technical team from preassessment information, 3/22/01
3.4.7. NRDAM/CME, vers. 2.51, January 2000, (CERCLA Type A model) with technical documentation (CD-ROM with electronic files)
3.4.8. Seabird Mortality Resulting form the M/V *New Carrisa* Oil Spill Incident February and March 1999, Ford, et al., May 14, 2001

3.5. Ecological Injury Assessment Regulatory Memoranda
3.5.1. Biological Injury Assessment: Analysis of OPA Regulatory Requirements as Sections 990.51 and 990.52: Injury Determination and Quantification, J. Jeansonne, memorandum to file, 6/10/02.
3.5.2. Biological Injury Assessment: Analysis of OPA Regulatory Requirements as Sections 990.27, Use of Assessment Procedures, J. Jeansonne, memorandum to file, 5/24/02.

3.6. Lost Beach Use Injury Determination & Quantification
3.6.1 An Economic Analysis of the Importance of Saltwater Beaches in Florida. Bell, F. W. and V. R. Leeworthy, 1986. Florida State University, Department of Economics, Tallahassee, FL, Florida Sea Grant College, Report Number 82, Sea Grant Project No. R/C-P-12.
3.6.2 "Discrete-Choice Contingent Valuation of Beach Recreation Benefits for Tourists

and Local Residents." Kaoru, Y., 1993. Marine Policy Center, Woods Hole Oceanographic Institution Contribution No. 8500, September 23.

3.6.3 Revised Report and Rebuttal: Assessment of Damages to Anglers and Other Recreators From Injuries to the Upper Clark Fork River Basin. Morey, E. R., R. D. Rowe and D. Waldman, 1995. Report to the State of Montana, Natural Resource Damage Program by RCG/Hagler Bailly, October.

3.7. Lost Beach Use Injury Assessment Regulatory Memoranda

3.7.1. Lost Recreational Beach Use Injury: Analysis of Regulatory Requirements for Injury Determination, Injury Selection, and Quantification, Tony Penn, memorandum to file, 4/22/02.

3.7.2. Recreational Beach Use Assessment: Use of Assessment Procedures, Tony Penn, memorandum to file, 4/22/02

4. RESTORATION PLANNING: ALTERNATIVES DEVELOPMENT, EVALUATION & SELECTION

4.1. Development of Alternatives, General

4.1.1. Trustee Conference Call Summary, Thursday, 3/22/01

4.1.2. Table: Florida Mystery Spill Projects Overview (undated)

4.1.3. Final Summary of Ecological Restoration Planning Call, 9/26/01

4.1.4. South Florida Multi-Species Recovery Plan, The Ecological Communities. U.S. Fish and Wildlife Service, Southeast Region, 1999.

4.1.5. The Southern Florida Avifauna. Robertson, W. B., Jr. and J. M. Kushlan, 1984. In P. J. Gleason, ed., Environments of South Florida: Present and Past II, pp. 219 - 257. Miami Geological Survey; Coral Gables, FL.

4.2. Sea Turtle Restoration Alternatives - Background and Documentation

4.2.1. Recovery Plan for the U.S. Population of Loggerhead Turtle, *Caretta caretta*, U.S. Dept. of Commerce and U.S. Dept. of the Interior, 1991

4.2.2. The Biological Conservation of Loggerheads: Challenges and Opportunities, B.E. Witherington, In Press

4.2.3. Lt. Jeff Ardelean, Florida Fish & Wildlife Conservation Commission, communication with Sramek re: statistics on enforcement against turtle poaching in south Florida counties, 1/23/02

4.2.4. News Press, Fort Meyers Edition, Tiny turtles crash beachside bachelor party, 7/4/97

4.2.5. Naples Daily News, Nesting section kickoff held at site recognized for protecting sea turtles, 5/2/00

4.2.6. The News Herald, County Commission tables turtle light ordinance, 1/23/02

4.2.7. Understanding, Assessing, and Resolving Light-Pollution Problems on Sea Turtle Nesting Beaches, B.E. Witherington and R.E. Martin, FL Dept. of Environmental Protection/FL Marine Research Institute Technical Report TR-2, 1996

4.2.8. Safer Crosswalks? In-Roadway Lights at Crosswalks!, Cloverleaf Corporation Product Brochure, undated

4.2.9. Embedded Roadway Lighting System, SR-AIA/Ocean Boulevard, Final Research Report, FL. Dept. of Transportation, January 2000
4.2.10. Coastal Roadway Lighting Manual: A Handbook of Practical Guidelines for Managing Street Lighting to Minimize Impacts to Sea Turtles, Ecological Associates, Inc. Report for Florida Power & Light Co., April 1998
4.2.11. Boca Experiment with Street Lights Keeps Sea Turtles from [Going] Astray, Orlando Sun-Sentinel, 12/3/01
4.2.12. Article 9, Environmental Standards - Palm Beach Co. Ordinance concerning turtle-friendly lighting
4.2.13. Brevard Co. and city ordinances

4.3. Sea Turtle Restoration Alternatives - Project Proposals
4.3.1. Sramek communication with Meghan Conti, FL FWC re: request for Palm Beach Co. locations to implement street light conversion projects, 1/15/02
4.3.2. Proposal to Increase Sea Turtle Hatchling Productivity in Palm Beach County, submitted by Paul Davis, February 2000
4.3.3. Virginia Barker, Brevard County Board of Commissioners, letter to Moore, NOAA re: proposal for protecting marine turtle hatchlings in Brevard County, 3/1/02
4.3.4. Sea Turtle Injury Restoration Alternatives Development: Notes on Additional Funding of Turtle Rehab. from Cold Stunned Sea Turtles, NOAA Case Team memorandum to the file, 1/11/02
4.3.5. Wieczynski communication with Jeansonne re: concurrence in lack of viability of turtle rehabilitation restoration alternative, 1/14/02

4.4. Seabird Restoration Alternatives
4.4.1. Save Our Seabirds, Inc., informational brochure

4.5. Water Column Restoration Alternatives
4.5.1. Penn communication with NOAA re: FL DEP transmittal of restoration project proposal, 2/11/02
4.5.2. Graphic, Proposed Mangrove Restoration Site at Virginia Key

4.6. Lost Beach Use Restoration Alternatives
4.6.1. Penn communications with Sid Leve, John U. Lloyd State Park re: restoration opportunities, 2/14/02
4.6.2. Carol Ingold, City of Fort Lauderdale, communication with Penn re: restoration opportunities, 2/14/02
4.6.3. Russell Setti, Broward Soil and Water Conservation District, letter to Penn re: canvassing of beaches affected by the spill for interest in sea oat plantings for restoration, 2/16/02
4.6.4. Kee Jung Eng, City of Hollywood, communication with Penn re. erosion control restoration projects, 2/22/02

4.6.5. Coastal Revegetation with Compost and Xeriscape Technology, T. Hamilton, G. Morris and R. Setti, in Proceedings of the Conference, Sustaining Environmental Quality: The Erosion Control Challenge, February 15-18, 1994

4.7. Restoration Scaling

4.7.1. Value-to-cost Compensatory Restoration Scaling, Tony Penn, memorandum to file, 6/13/02

4.7.2. Natural Resource Damage Assessment for the Tampa Bay Oil Spill: Recreational Use Losses for Florida Residents. Environmental Economics Research Group, 1998. Draft Report for Florida Department of Environmental Protection and the National Oceanic and Atmospheric Administration.

4.7.3. The *American Trader* Oil Spill: A View from the Beaches. Chapman, D.J., W.M. Hanemann, and P. Ruud, 1998. *AERE Newsletter* 18(2): 12-25.

4.7.4. Scaling Juvenile/Adults to Hatchings, D. Berhart concurrence, 4/17/02

4.7.5. Conversion Factor for Sea Turtle Life Stages, phone log of Jeasonne with Bernhart, 4/17/02

4.7.6. Jeansonne communication with Manen, Sea Turtle Restoration Scaling Method, 4/22/02

4.7.7. Wiezynski email to Jeansonne of no comment to Draft Sea Turtle Conversion Ratio Memo to File, 4/22/02

4.7.8. Sea Turtle Primary Restoration Scaling: Determining the number of hatchlings required to replace the injured juvenile and adult sea turtle, Jeansonne memorandum to the file, 4/26/02

4.7.9. Service-to-service Compensatory Restoration Scaling, Tony Penn, memorandum to file, 6/14/02

4.7.10. Cost of beach front property acquisition for sea turtle restoration, Sramek memorandum to the file, 6/5/02

4.7.11. Estimating the Enhancement of Secondary Production: Oyster Reef vs. Artificial Reef Construction. Peterson, C.H. and Associates, 2000. Report submitted to NOAA Damage Assessment Center.

4.7.12. Effectiveness of Embedded Lighting Project. Tom Moore, memorandum to file, 4/25/02.

4.7.13. Protecting Fish and Wildlife Habitat through an Understanding of the Minimum Light Requirements of Subtropical-Tropical Seagrasses of the Southeastern United States and Caribbean Basin. Kenworthy, W.J., 1992. Ph.D. Dissertation, North Carolina State University.

4.7.14. Mangrove Habitat Injury Assessment and Scaling Protocals Final Report. Michel, J., October, 2001. Report submitted to NOAA Damage Assessment Center.

4.8. Restoration Selection - Evaluation of Alternatives

4.8.1. Restoration Planning: Project Identification and Initial Evaluation, Trustee memorandum to the file with attached matrix,